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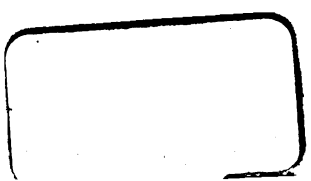

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REPORT

OF

THE BOARD OF DIRECTORS

OF INTERNAL IMPROVEMENTS

OF THE

STATE OF MASSACHUSETTS,

ON

THE PRACTICABILITY AND EXPEDIENCY

OF A

RAIL-ROAD

FROM BOSTON TO THE HUDSON RIVER,

AND

FROM BOSTON TO PROVIDENCE.

SUBMITTED TO THE GENERAL COURT, JANUARY 16, 1829.

To which are annexed,

The Reports of the Engineers,

CONTAINING THE RESULTS OF THEIR SURVEYS, AND ESTIMATES OF THE COST OF CONSTRUCTING A RAIL-ROAD, ON EACH OF THE ROUTES SELECTED.

WITH PLANS AND PROFILES OF THE ROUTES.

Boston:

PRESS OF THE BOSTON DAILY ADVERTISER,

W. L. Lewis, Printer, Congress-street.

1829.

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REPORT

OF THE

BOARD OF DIRECTORS

OF INTERNAL IMPROVEMENTS.

Commonwealth of Massachusetts.

TO THE HONORABLE SENATE AND HOUSE OF REPRESENTATIVES,

The Board of Directors of Internal Improvements respectfully present the following Report.

Before proceeding to a consideration of the advantages of the proposed Rail Roads, it seems important to fix some definite idea of the kind of structure, which is believed to be best adapted to the purposes in view. The nature and objects of the undertaking demand, that the work should be built of the most substantial and durable materials, and on a plan to accomplish the objects proposed in the most perfect and satisfactory manner, so far as this can be done, without exceeding such reasonable limits of expenditure, as shall be prescribed by the probable amount of income to be derived from it.

The most approved Rail Roads in Great Britain are formed of solid bars of wrought iron, rolled into a form best suited to give them strength, and presenting on

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the upper edge, which is slightly rounded, a thickness of two and a quarter inches, forming a surface of that width on which the wheels of the carriages run. The rails thus formed, of the requisite strength, weigh 35 lbs. each to the running yard. They are confined in their places, and supported at every yard of distance, by cast iron *chairs*, which are bolted to a foundation stone, and are formed with a nitch or groove, in which the rails are inserted and confined by an iron bolt.

The high cost of iron in this country, and the great abundance and cheapness of fine granite in this vicinity, and on the line of the proposed rail roads, strongly recommend the adoption of rails of a different form. In this climate it is necessary that the foundations for the rails, of whatever material they are formed, should be laid below the reach of frost. It is found that the cost of a continuous stone wall, laid so deep in the ground as not to be moved by the effects of frost, and surmounted by a rail of split granite of about a foot in thickness and depth, with a bar of iron placed on the top of it, of sufficient thickness to form the track on which the carriage wheels shall run, is much less than that of the English iron rail, and that rails of this construction, so far as can be judged from experiments which have yet been made, possess all the advantages of solidity, durability, and strength. For the proper adjustment of the bar of iron, and to give proper play to the flanges of the wheels, it is necessary that the upper surface of the granite rail, and also the upper edge of the inner face, should be hammered; and the bar must be attached to the rail, by means of bolts or rivets, at distances of about a foot from one another. The pair of rails thus placed, at the uniform distance of five feet from each other, as nearly horizontal as possible, with the space between them filled to within six inches of the upper surface with earth and gravel,

so as to form a path for the horses employed in drawing the carriages, constitute the Rail Road.

It is a simple structure, and its advantages are so manifest, that it is remarkable that it has not been sooner introduced, into extensive use. The advantage which it possesses for giving an easy motion to heavily loaded carriages, arises from the even and unyielding surface of the iron rail, on which the wheels of the carriages travel. By this means, if the rails are level, every obstacle to the motion of the load is removed, except the friction at the axles of the carriages, and a slight friction at the flanges which are attached to the tires of the wheels, for the purpose of keeping them upon the rails. The amount of this friction, both at the axles and at the flanges, on a good rail road, and with carriages of a proper and convenient construction, has been ascertained by accurate observation, on rail roads which have been long in constant use. The precise degree of resistance from this cause depends upon the degree of evenness and solidity of the rail, and the form and size of the axles and wheels; but with carriages in common use, of a cheap and convenient construction, with wheels of three feet in diameter, and on the common English iron rails properly laid, the power necessary to keep a load in motion, when the road is level, is found not to exceed 11 lbs. to a ton; that is, no greater exertion is required to move a load weighing 2240 lbs. than to raise a weight of 11 lbs. suspended by a cord, passing over a pully. The friction is in proportion to the weight of the load, and is the same, whether the motion is rapid or slow.

When the road is not level, if the motion of the load is in the ascending direction, there is a further resistance to be overcome, proportioned to the degree of inclination, but if the motion is in the descending direction, there is a corresponding diminution of resistance. The measure of this gravity as it acts upon the motion

of the load on a rail way inclining to the horizon, is about one pound per ton to each 2 1-2 feet of uniform inclination per mile; or 11 lbs. to each 26 feet of inclination. To compute the power therefore which is required to move a given weight, on a rail road of a given degree of inclination, one pound per ton for each 2 1-2 feet of inclination must be added for the ascending motion, and deducted for the descending motion. At an inclination of 26 feet per mile, the power of gravitation is equal to the resistance from friction, and consequently, to produce motion in an ascending direction requires double the power necessary for overcoming the friction alone; and in the descending direction, the resistance is overcome by the gravity, so that a very slight exertion is required to produce, accelerate, or retard the motion at pleasure, or to make it conform with the most convenient speed of the moving agent. At any degree of inclination not exceeding 26 feet in a mile, the exertion required to move the load in ascending, is just as much greater than it would be if the road were level, as it is less in descending, so that the labour of a horse, travelling with a load on a road which is undulating, but which never exceeds in inclination the rate here mentioned, is as much diminished in travelling in one direction, as it is increased in the other, and the average exertion required is the same as if the road were level. But if the degree of inclination is greater than that above mentioned, the increased labour of ascending meets with no equivalent compensation in the diminution of labour in descending, so that the average of exertion required is increased in proportion to the increased inclination beyond that limit.

It is found by experience that a steady and long continued exertion of strength, by a horse, is more fatiguing to him, than even a greater exertion occasionally remitted. The labour of drawing a load over a rail road, of various degrees of inclination, not exceed-

ing the limit above mentioned, would be but a little more severe, than that of drawing the same load, an equal distance, over a similar rail road uniformly level. If the inclination is uniformly in one direction, the compensation for the increased effort in ascending, is found, especially if the horses are changed at short stages, in the greater ease of returning.*

Horses employed in drawing heavy loads are often made to exert a power, for short distances, equal to raising a weight of 3 or 400 lbs. But the measure of steady performance through the day, for a horse moving at a slow and natural pace, and travelling 20 miles a day, may be taken at about 125 lbs. This exertion is equivalent to drawing a load of 11 or 12 tons, the weight of carriages included, on a good level rail road. If we suppose a rail road to be, for the most part nearly level, with undulations according to the face of the country, the inclinations, in either direction extending sometimes to 26 feet in a mile, but never far exceeding that limit, an average load adapted to it, for a single horse, travelling at a slow pace, may be estimated at 10 tons. Computing on the same principles, if the inclination of the road, for the most part, exceeds 26 feet in a mile, and varies from that rate to 78 or 80 feet, the average load for a single horse, which may be drawn with the same ease as the ten tons in the other case, should not exceed 5 tons. In this last estimate, the resistance from friction, together with that from gravity, in an ascent of 26 feet per mile, is considered as equal to that from gravity alone, in an ascent of 52 feet. To ascertain the precise measure of increased

* The labour of the horse may be still further relieved, by providing a platform, placed on small wheels, on the long descents, on which the horse himself may ride. This expedient, singular as it may seem to persons unaccustomed to observe the ease of locomotion on a rail road, is adopted with success on the Darlington and Mauch Chunk rail roads, and the horses eat their provender, while they are returning to a point where their labour is to be resumed.

exertion required from the horse, on an ascending rail road, a further allowance should be made for the increased labour of moving his own weight. This may be considered, as equal to that of overcoming the gravity of a part of the load equal to his weight, which is in general about half a ton. With this deduction, the load which can be moved on the steeper parts of the road above described, with the same average exertion, in ascending and descending, as is required to move ten tons on the nearly level road, is reduced to 4 1-2 tons. But it will be sufficiently accurate, for most purposes, to allow two horses on the steep parts of the road, for the conveyance of loads, which are suited to one horse on the level parts.

From this explanation it will be perceived, that although the most level route is the best suited to the rail road, an absolute level is not required, as in the case of a canal. In building the rail road, however, as in laying out a canal, it will be expedient to bring the line of the road as near to a level, by the choice of the route, and by excavation and embankments, as is practicable at a reasonable cost, and without material deviations from a direct course. The degree of expense which may be advantageously incurred, in reducing the inclination of the road, must depend upon the nature and amount of the transportation, to be expected upon it.

It must be obvious, that it is only the shorter undulations that can be avoided, by means of excavation and embankments. Where there are high and extensive ridges to be passed, it is impracticable to reduce the road to a level. All that can be done is to seek the route which affords the most favourable surface; and where an elevation of the line of the road cannot be avoided, to apply a sufficient power for surmounting it.

There are two modes of applying the additional power, which is rendered necessary by the uneven

surface of the country, and the consequent steep inclinations of the road. One is by selecting the route which affords the most gradual ascent, to the summit to be passed, though it may not be in the most direct course; distributing the elevation as uniformly as possible, and after reducing every part of the road, as nearly to a level as is practicable, within the proper limits of expenditure, by applying an additional travelling power, for drawing the loads, on all such parts of the road so constructed, as shall be found to require it. It is found, by the surveys which have been made, that the heights between Boston and the Hudson river may be passed by an inclination not exceeding, in any part, the rate of eighty feet in a mile, and without prolonging the distance more than an eighth or tenth part, beyond that of the most direct road. A rail road laid with as uniform an inclination as is practicable, on the line of this survey, will require on the steepest parts of it double the power which would be necessary, if the road were nearly level. On the road so constructed, two horses will be required on about two fifth parts of it, for the conveyance of such loads as are adapted to the power of a single horse on the level parts. The demand for this additional power, will consequently, if this mode of construction should be adopted, require an additional expense of two fifths for locomotive power, over what would be necessary, if the road were level from one extremity to the other. The other expenses of conveyance, would be no greater on the rail road with this degree of inclination, than if the whole were level. It will be perceived therefore, that although the uneven surface of the country, over which the rail road must pass, will diminish the facility of travelling and transportation, below that which it would afford if it were practicable to make it level, this diminution is yet inconsiderable, compared with the vast facilities which it still affords. The roads which

now traverse this part of the country are in some parts mountainous, and in all parts hilly. They can be travelled only with moderate loads, and at a slow pace. The loads which can be conveyed, by a given power on a rail road, of the construction here described, are probably greater, compared with those which are usually transported on the roads now in use, through the same tract of country, than those which can be conveyed on a level rail road, when compared with the loads usually transported, on the good public roads of a level country.

This additional labour and cost of transportation, arising from the uneven surface of the country, is much less than would be expected, from the general character of the country, and the obstacles encountered in the ordinary modes of transportation; and it is not greater than is incurred in almost any mode of inland communication, on the most favourable routes. There are no canals, of any considerable extent, which are not subjected to the expense of locks, and the consequent charges of attendance, and delay, which increase the cost of transportation, to a greater extent, than the additional charges for overcoming the gravity of loads, transported on a rail road, like that here described.

The other method alluded to, of surmounting the elevations which occur in the course of the road, is by stationary powers, acting on inclined planes, to be built on all the declivities, which are too great to be traversed by means of the ordinary travelling power, required on the level parts of the road. The route in this case may be selected, with reference principally to the advantages of the most direct course, and the least change of level in the whole, without much regard to the rapidity of ascent, where a change of level is necessary. The inclined planes may rise at any convenient angle, not exceeding 5 or 6 degrees, and may be

of any length which the natural face of the country may render convenient. The cheapest power which can be applied to this purpose, is that of water, which is found on a part of the declivities to be passed, in abundance. On some of them, however, it is probable that no water is to be obtained, in which case animal power might be substituted. The same degree of power will overcome the gravity of the load, and raise it a given number of feet above the level, when applied by means of stationary machinery, or a steep inclined plane, as when applied in the usual mode of travelling, on a plane inclining 80 feet in a mile, or at any less rate. If it should be necessary therefore to make use of horses alone for the stationary power, the cost would be no greater than that of the necessary additional travelling power, in the other method. The friction of the load would be the same in a given distance, on a steep as on a gradually inclining plane. The friction of the machinery would afford an additional resistance to be overcome, if there should be no saving of distance. But for every portion of distance saved, the friction of the whole load would be saved; and if there were no saving of distance, there would be another advantage to be set off against the friction of the machinery. The additional horses employed on the gradual ascent, to overcome the gravity of the load, must return through the whole distance, without producing any useful effect, with a loss of time, and unless they are carried back on carriages, of strength. This loss, as well as the attendance requisite on short sections, in bringing them back, is avoided, by applying the power by machinery. The most simple mode of applying it would be by means of a wheel, which shall move an endless chain, passing from the top to the bottom of the inclined plane, over pullies placed between the rails of the two tracks, the ascending side of the chain on one track, and the descending on the

other. To this chain, on the ascending side, the ascending carriages would be attached, and on the other side, the descending carriages. If the wheel for putting the chain in motion, is moved by water power, there need be no waste of power, as the gates may be closed, except when the carriages are ascending.

Many of the declivities would be by the side of streams which have an ample supply of water, with a fall equal in most cases to the elevation to be passed by the road, and affording a surplus for manufacturing purposes. The amount of stationary power required at each elevation for raising the load over the plane, would be only equal to that which would be necessary, in addition to the ordinary travelling power, in the other mode of passing the same height by a gradual inclination. The motion of the revolving chain, might be regulated to any convenient velocity, for the ascent or descent of carriages on the road. Whether the power can be so applied with the same degree of safety, as by the use of horses in the ordinary mode of travelling, and what degree of saving may be made in the distance, to compensate for the expense of machinery, and for the delay in attaching the load to the chain at each ascent, are questions which require a more full investigation than has yet been given to them. The additional cost of this mode of construction, if any, including that of the machinery, stationary powers, and attendance, would be included in the general charges of making and maintaining the road, and provided for in the tolls demanded for the use of the road; and the cost of locomotive power in travelling would be reduced to the amount, which would be requisite if the whole road were level. If this mode of construction should be adopted, it would be a question to decide, in reference to each considerable elevation of ground to be passed, by the proper estimates and calculations, which method of surmounting the

obstacle would be ultimately cheapest; reducing the elevation by excavation, passing it by the travelling power, or passing it by stationary power. When the elevations are short, the cost of reducing them by excavation and embankments, would not be excessive; yet it would probably be found expedient to suffer short undulations, to an extent considerably exceeding 26 feet, as such inclinations might be overcome, without any serious impediment, by a greater temporary exertion, or a slower motion of the horse.

It is not necessary to decide, in the present stage of our inquiry, which mode of construction is preferable. This can be done satisfactorily, only after having become thoroughly acquainted with the face of country to be passed, its adaptation to each mode of construction, the facility of obtaining the necessary water powers, the amount of travel which will be accommodated by the road, and the practicability of the methods of applying the stationary power, without hazard of delay or of accident. A part of the necessary information could not be obtained without more minute surveys than seemed necessary in the present stage of this undertaking. The question, as well as some others of less moment in relation to the construction of the road, may be safely left to be determined, on more full inquiry, and mature consideration, by those who may be entrusted with the execution of the work.

The most simple and obvious method of construction, is to pursue the route which presents the least inclination, and which requires no power but that of horses, travelling on the road. No other plan could be well adopted for the first surveys, because, to form any other system, required the information which the surveys only could afford. The surveys thus made serve as a basis for estimates which are sufficient for all present purposes, as they show the practicability of one mode of construction, free from any very

formidable objections; and this mode may be adopted in case no other shall be found on full investigation, entitled to a preference. Any further surveys, made for the purpose of showing the practicability of any other mode of construction, would be of little use in determining the question, whether it is expedient to undertake the making of the rail road or not; and until that question is determined, it would seem entirely unnecessary, and inexpedient, to incur any further expense in making such surveys.

The Directors having caused such surveys to be made between Boston and the Hudson river, as were thought necessary, to enable them to form a judgment of the comparative advantages of the several routes which appear to be practicable, have selected the southern route, passing through Worcester and Springfield to Albany, as that which admits of being made at the least cost, and of being travelled with the greatest ease, and which will also accommodate the largest population. The grounds of this preference will be more particularly stated, and some description of the other routes given, in another part of this report.

The selection which has been made, however, must be considered as applying to the general direction, and not to the precise location, of the line described. For the final location, a much more deliberate survey will be necessary, to admit of the choice of the best ground, and the adaptation of the route to the best mode of construction; and should a different mode of construction be adopted, from that on which the estimates are founded, considerable deviations will probably be made, for shortening the line. A different termination, in the city of Boston, may also be selected, if on more deliberate examination, it should be found, that any other termination would better promote the various objects in view.

The line indicated by the surveys already made, is

particularly described in the report of the Engineer, and an estimate has been made by him, of the cost of constructing upon it, from Boston to the boundary line of the state of New York, a double rail road, in the form, and of the materials which we have already described. This line departs from Charles street, in Boston, crossing Charles river to Cambridgeport, and again from Cambridgeport to Brighton. The estimates are for wooden bridges across the water, a solid road supported by stone walls, across the flats, and an embankment of earth across the marsh. The line proceeds through Brighton and Newton, to Charles river, which it crosses again near the Newton Lower Falls, crosses the Worcester turnpike, in Needham, and continues on the south side of that road, at a short distance from it, to Worcester. It proceeds thence through Leicester and Spencer to the Chickapee river, in Brookfield, and thence pursues the channel of that river to Springfield. It there crosses the Connecticut river, by a wooden bridge, on stone piers, about a mile north of the present bridge, proceeds in a nearly direct course on the north side of Westfield river, to the western part of the town of Westfield, and thence along the southern branch of the river, to the source of its western branch in Washington. After crossing the height of land, which divides the waters of Connecticut river from those of the Housatonic, it descends by a branch of the last named river to Pittsfield, and proceeds thence through Richmond to the boundary line of the state, near the north line of West Stockbridge. From this point, two lines have been surveyed to Albany, one by Mr. Young, of Albany, under the direction of the Commissioners of the state of New York, and the other in the autumn of 1827, under the direction of the Commissioners of this state, by the present engineer of this board. The distance by the line here described, is 94 miles and 64 chains from Boston to Connecticut river,

160 miles and 44 chains to the border of the state, and by the shortest of the lines surveyed, 198 miles and 6 chains to Albany. The direction of this line will be more clearly perceived, by reference to the plans of the several surveys which accompany this report.

Before the estimates for the construction of the road were made, Mr. Willard an eminent architect, who has been particularly conversant in the erection of edifices of granite, and with the quarrying of this kind of stone, was employed to examine, in company with Mr. Makepeace, one of the Directors, the quarries of granite near the line of the road. His report on this subject, which shows that abundant supplies of excellent stone are to be found along the line from Framingham to Palmer, and from Russell to Washington, is annexed to this report. Measures were also taken by the Directors, to obtain from the manufacturers in England, satisfactory information of the cost of iron, rolled to the shape best suited to be placed on the rail stone, to form the track of the rail. With these facts, and those derived from the surveys, with such others as come within the scope of the inquiries, and practical information of the Engineer, he has made his estimates of the cost of constructing the road. These are stated in detail in his report.

According to these estimates, the average cost per mile, of forming the road 22 feet in width, from Boston to the border of the state of New York, including the excavation, embankments, walls, bridges, culverts, and other work preparatory to laying the stone foundations, will be - - - - - $4,770 06

Iron for 4 rails, with bolts, per mile, including 4 passings from one track to the other and back, - - - - - 1,985 04

Rail stone, including the quarrying, carting, hammering, laying, drilling, and putting on the iron, per mile, - - 6,020 80

Digging trenches, carting stone, and laying wall to support the rail stone, and gravelling horse paths, per mile, $2,164 80

$14,940 70

If we add to this amount ten per cent, to cover the cost of further surveys, superintendence, and unforseen contingences, the whole estimate will be $16,434 77 per mile. At this rate, the cost of making the road from Boston to the border of the state of New York, on the line which forms the basis of the estimates, would be $2,638,628 64, and of carrying it to the city of Albany $3,254,876 46.

It has been the desire of the Engineer, as well as of the Directors, that the estimates should be such as will cover the cost of the work under all probable contingences, and as may therefore be relied on as representing the utmost cost likely to be incurred. No particular estimate has been made of the cost of land, damage to private property, the cost of fences, and of stone in the quarry. Assurances have been given very generally, that no claim will be made for damages or compensation, for land or fencing. Some attempts were made to obtain formal releases, but it was found difficult to accomplish this object, to any considerable extent, before the final location of the road. The amount of damage will be small, and there is reason to believe that, in most cases, none will be claimed. Whatever it may be, the allowance of 10 per cent. included in the estimate, it is presumed, will be sufficient to cover it, with all other contingences.

The inclination of the different parts of the road, from Boston to the border of the state, as it is laid out for the estimates, is as follows:

Level,	9 miles,	in	17	unequal	sections,
Inclining from 1 to 26 feet per mile,	69 „		99	„	„
Do. 26 to 52 feet,	39 „		71	„	„
Do. 52 to 80 feet,	43½ „		48	„	„

The exact inclination, the length of the several sections, the quantity of earth to be removed in graduating, the cost of excavation and embankments, and of bridges, walls, and culverts, are exhibited in detail in the report of the Engineer. The various inclinations are also exhibited, in the profile view of the surface of the ground, annexed to this report.

By adding the distance, at different rates of inclination between the western border of the state and Albany, as obtained from the survey of 1827, we find that the character of the route between Boston and Albany, will be as follows. In travelling from Boston to Albany, the parts of the road which are

	Miles.	
Level, measure - -	13	149 miles,
Descending, - -	94½	
Ascending from 0 to 26 feet per mile, -	41½	
Do. do. 26 to 52 do.	25	49 miles,
Do. do. 52 to 80 do.	24	

In travelling from Albany to Boston, the road will be

	Miles.	
Level, - - -	13	149 miles,
Descending, - -	90½	
Ascending from 0 to 26 feet, - - -	45½	
Do. do. 26 to 52 do.	21¼	49 miles,
Do. do. 52 to 80 do.	27¾	

It is easy to calculate, what degree of power will be required, to travel with loads of a given weight, on every part of a rail road so constructed. The principles above stated will afford all the data for this calculation. The power of steady exertion, of a single horse has been estimated to be equivalent to that required for moving 10 tons on a level rail road, including also all inclinations not exceeding 26 feet in a mile. This estimate supposes 2240 lbs. to the ton. If we exclude a quarter for the weight of carriages, there will remain 16,800 lbs. for the load. For greater safety in the calculation, we will suppose the load for a single horse, exclu sive of wagons, to be 16,000 lbs. or 8 tons, by the statute of this Commonwealth. Two horses therefore with a single driver, would be sufficient to conduct several carriages, conveying 16 tons, on all the level and descending parts of the road, and also on the parts ascending, at a rate not exceeding 26 feet in a mile. On the portions ascending above 26 feet in a mile, if stationary powers are not provided, additional horses will be required, except where the excess is slight and for short distances. In a temporary exertion, such as horses travelling with heavy loads, on common roads, are always required to make in passing hills, the power of the two horses would be competent to draw the sixteen tons over ascents of 40 or 50 feet to a mile. But to save the strength of the horses, and to maintain a convenient rate of speed, it would be expedient to provide additional horses, at least on all the portions of any considerable extent, where the inclination exceeds 26 or 30 feet. On the parts of the road inclining from 26 to 52 feet, measuring 39 miles between Boston and the New York line, and about 46 miles between Boston and Albany, one

additional horse would be sufficient. On the inclinations from 52 to 80 feet, two additional horses, or double the number required on the level parts of the road would be necessary. The sections which have this inclinations between Boston and the New York line measure 43 1-2 miles, and for the remaining portion of the road, from the state line to Albany nearly 8 1-2 miles must be added, making 52 miles.

If we divide the distance from Boston to Albany into ten stages of 19 1-2 or 20 miles each, 20 horses, employed one day each, will be required to convey the load of 16 tons, exclusive of the additional power necessary on the steep inclinations. If stationary powers are provided, this will be the only horse power required. To surmount these acclivities, by additional travelling power, will require eight additional horses; viz. two on the inclinations from 26 to 52 feet, and six on those from 52 to 80 feet. The same object may be effected by a reduction of the loads, or in part by taking a longer time for making the journey. But the expense of power, in proportion to the weight moved, would be in each case about the same.

The most easy and convenient rate of travelling would perhaps average about three miles an hour, and the journey may be accomplished in four days. The wages and subsistence of a man to conduct the teams, may be estimated at a dollar a day. The cost of the labour of a horse, including interest on the purchase, depreciation of value, hazard, keeping and shoeing, is about 50 cents a day. The cost of six carriages, sufficient to carry 16 tons, 75 cents a day. An allowance must also be made for profit to the carrier, and the hazard of going sometimes partially loaded, of about 50 per cent. on all

expenses. This allowance it is thought will be sufficient to cover a fair charge for heavy goods, paying the lowest rates of freight. Some additional profit might be obtained by higher charges on more costly goods. Upon these data, the cost of transportation between Boston and Albany, may be estimated as follows:

If the Road be made with Stationary Powers,

20 horses at 50 cents per day,	$10	
1 man, 4 days, at $1,	4	
Carriages, 4 days, at 75 cts.	3	
	17	
Add 50 per cent,	8	50
For conveyance of 16 tons,	25	50
Cost per ton, exclusive of tolls,	$1	59

Without Stationary Powers,

20 horses at 50 cents,	$10	
8 horses additional,	4	
1 man, 4 days,	4	
Carriages,	3	
	21	
Add 50 per cent,	10	50
For 16 tons,	31	50
Cost per ton,	1	97

These estimates are intended to show the cost, exclusive of tolls, at which heavy articles, paying the lowest rates of freight, and of which it may be presumed there will in general be a sufficient quantity to employ the regular carriers, so that not much loss may be sustained from want of freight. These rates are perhaps lower than the cost of transportation on any of the canals in this country,

and lower than the average rates on the rail-roads in Great Britain; but very little lower, as will presently be shown, than the rates charged, for freight including tolls, on the principal articles of transportation on the Stockton and Darlington rail road, although the cost of locomotive power there used, is greater than that of horse power in this country.

The rate of tolls to be charged on the rail road, would be subject to the discretion of the managers, to be so regulated as best to benefit the public, and at the same time to secure the highest income. To gain both objects, it would be expedient to fix the tolls at so low rates, as to secure to the road a preference, over all other channels of conveyance. It would also be expedient to adopt the principle, on which tolls in most similar cases are regulated, of exacting a lower rate per ton, for bulky and cheap articles, than for those which are more costly. In this way a trade in many agricultural products would be promoted, which otherwise could not be prosecuted. On articles carried through from Boston to Albany, or the reverse, it would be only requisite, for securing to the rail road the whole transport, that the freight should be as low as the freight, together with insurance, by water; as the greater expedition and certainty of conveyance would be advantages of sufficient moment to secure a preference. The customary rates of freight by sloop navigation, between Boston and Albany are from $3 to 4, per ton, but it is sometimes procured as low as $2,50. The usual rate of insurance is about 3-4 per cent. The lowest charge for freight of flour is 25 cents per barrel, which with the addition of insurance will make 28 or 30 cents.

If we add to the foregoing estimates of the cost

of transportation by the rail road, one dollar a ton, for tolls, a sum equal to a trifle more than half a cent a mile, it will give $2,59 and $2,97 per ton. These rates on the barrel of flour would be equal to 26 and 30 cents. Either rate would probably be low enough to secure to the rail road the carriage of all the flour between Albany and Boston. But if these rates should be found too high, a reduction of 5 cts. per bbl. might be made by reducing the toll one half. Other articles, being more costly, pay a higher amount of insurance per ton, when carried by sea, and consequently would bear a higher freight, when carried by land, and a higher rate of toll. All articles also, conveyed to or from the intermediate places, could well bear a much higher rate of toll, than those which are carried from one extreme to the other, because the accommodation to those places is greater. The cost of transportation by water, from Springfield to Boston or New York is greater, and will be, even when the Enfield locks are completed, than from Albany to Boston. The cost by the rail road will not exceed half this amount, and consequently all articles brought upon it from the Connecticut river to Boston, may pay double the toll above mentioned, and the cost of conveyance will still be less, than the lowest rate of freight by water. Timber, firewood, and the most bulky descriptions of agricultural produce may be brought upon the rail road, and well afford to pay the highest rates of toll here mentioned, viz. a cent a mile per ton.

The next subject to be considered, is the adaptation of the proposed rail roads to the conveyance of passengers. It is well understood that horses when travelling rapidly, are capable of exerting upon the load a much less degree of moving power

than when travelling slowly. To avoid resistance to the motion of the load therefore, by means of a smooth and level surface, is the more important, in proportion to the increased cost of the power necessary for overcoming it. The resistance to the motion of a carriage on a rail road, whether from friction or gravity, is no greater when the motion is rapid, than when it is slow, and there will be no obstacle to travelling on it as fast, at least, as is practicable in stage coaches, on the very best roads. Computing on the principles adopted in the foregoing calculations, it will be found that an active horse may travel 12 or 13 miles a day, at the rate of 9 miles an hour, including the necessary stops, and drawing with a force equal to raising a weight of 28 lbs. This power would be sufficient to draw, on a rail road of the description above supposed, a weight of 2 1-2 tons, or a carriage with 20 passengers, with their baggage. On this assumption, the estimate of cost in transporting passengers, by the rail road, between Boston and Albany, if provided with stationary powers will be as follows:

16 horses travelling 12 or 13 miles each, at 50 cts.	$8 00
2 men and 1 carriage, - -	3 00
	11 00
Add 50 per cent, - - -	5 50
For 20 passengers, - - -	16 50

For each passenger, 82 1-2 cents.

Or if we suppose the road to be constructed without stationary powers, two horses will be required instead of one on those stages which include the steepest parts of the road, to the number perhaps of six additional horses, in which case the estimate will be

22 horses at 50 cents,	- -	$ 11
2 men and 1 carriage,	- -	3
		14 00
Add fifty per cent,	- - -	7
For 20 passengers,	- -	21 00

For each passenger one dollar and five cents. To each estimate add two dollars, for toll, and it will make $2,82 or $3,05 for conveyance from Boston to Albany in 22 hours.

In the foregoing estimates we have supposed that horses will be exclusively used for the travelling power. On the Rail Roads recently built, and now building in England and France, it is proposed to make use almost exclusively of locomotive engines; or carriages moved by a steam engine placed within them, of a sufficient force to draw after them, without the aid of animal power, a succession of 20 or 25 loaded wagons. These engines are in operation with entire success, on several Rail Roads in England. Where coal is abundant and cheap, and where the subsistence of horses is dear, steam power may be advantageously used for many purposes, in which it cannot be economically employed in a country where coal is dear. For the purpose of determining, whether locomotive engines can be advantageously employed on Rail Roads in this country, we have examined the estimates of the cost of maintaining these engines in England; where they have been brought to a high degree of perfection, and where the cost of coal for fuel, which constitutes a fourth part of the expense, does not exceed a third part of its cost here. We find that by the lowest of these estimates, the cost of the effective power of these engines is greater,

with the advantages there possessed, than that of maintaining horses to produce the same power, in this country. It would be otherwise, however, if it were important to move large loads, of 50 or 100 tons, at a rapid speed.

These facts show that the cost of transportation on a rail road in this country, by horse power, will be less than in England, by either horse or steam power. The cost of oats and other food for horses in England, in general, is nearly double its cost in this country, and that of this description of animal power must therefore be greater in nearly the same proportion. The rates of tonnage therefore charged for transportation on rail roads in England, cannot be taken as affording a just criterion, of the rates which may be charged in this country, though they will serve to show in some degree the chepaness of this mode of transportation. The rates of tonnage fixed by the proprietors of the Stockton and Darlington rail way, for the cost of transportation and toll, vary according to the description of the goods conveyed, from a half penny, to three pence sterling a ton, per mile. For all coal, lime, and stone, which is destined to be shipped on board vessels at Stockton, and for stones and gravel to be used for making and repairing public or private roads, the rate of tonnage is a half penny, or one cent a mile, per ton. This rate is probably intended to give a fair rate of profit, as it applies to by far the greater part of the transportation; the principal object of the rail road being, the shipment of coal from Stockton. For coal, for consumption, and for slate, lime, timber and manure, the tonnage is a penny half penny, or three cents a ton per mile, the competition, in the transport of these articles, being only with ordinary land con-

veyance. For meal, flour, grain, hay and other articles, the tonnage is 2d per mile, and for goods and merchandize not enumerated, 3d—these rates even, being much less than the cost of common carting. The lowest rate of tonnage on the Darlington rail way, embracing the principal transport, where there is very little return freight, is but a trifle higher than our estimate of the cost of transportation per mile, exclusive of toll, on a rail road from Boston to Albany; yet the profits of this transportation pay a high dividend on the cost of the road, which exceeded £10,000 sterling a mile.

Having thus ascertained, as nearly as is practicable, in the present state of our information on this subject, the degree of facility which the proposed rail road would afford to the motion of loaded carriages, the next object of inquiry is to determine whether, with these facilities, the amount of transportation and travelling required by the business and intercourse of the country, and likely to be brought upon it, is sufficient to afford an indemnity for the cost of the work. The income of the road will be derived from two distinct sources, viz. the conveyance of merchandise, produce and every description of property; and the transportation of passengers.

In making an estimate of the amount of merchandise and property likely to be transported on the Western rail road, we must consider, first, the business between Boston and Albany; and the country beyond that termination of the road, 2d, that of the intermediate country, in the vicinity of the proposed route, and 3d, that of places remote from the line of the road, but which would come upon it in a part of its course, to and from the great markets situated at its extremities.

The estimates which we shall present of the amount of merchandise transported between Boston, and the cities of Albany and Troy, are founded on documents furnished to us, by Ebenezer Baldwin and George Tibbets, Esqrs. commissioners of the State of New York, for procuring surveys of that part of the several routes, leading from Boston to the Hudson River, which is within that state. From these documents it would appear that there was imported into Albany directly from Boston, in the year 1827, merchandise to the amount of 6,091 tons,

Exported to Boston, direct,	12,271
" by river craft, to N. York,	4,590
Imported at Troy from Boston, direct,	2,100
Exported from Troy to Boston, direct,	2,660
Indirect trade with Troy, by tow boats, river craft, and New York packets,	1,190
	28,902

The business of 1828 is supposed to have been greater, and accordiug to a report made by the Dock-master of the city of Albany, the tonnage at that port, employed in the trade with the Eastern ports, increased fourfold, in a space of six years, from 1821 to 1827. There is reason to suppose that it will continue to increase, with the growth of the city of Albany, and of the Western country, and with the increase of manufactures in the Eastern states, even if it should continue to be prosecuted, in the present mode. Every improvement in the means of communication, by which the transport of merchandise may be rendered cheap-

er, safer, more rapid, and more regular, will of course accelerate the increase. A still greater increase in the amount of this business, in case of the establishment of the Rail Road, may also be expected from two other causes. 1st, The ease and rapidity of travelling will not only greatly promote the personal intercourse between the two sections of country, but the facility of this intercourse will lead to an increase of mercantile transactions. 2d, The continuance of this means of communication through the winter, (with the exception of a short period, in perhaps each season, when the Rail Road may be obstructed, in common with other roads by a deep snow,) will not only afford the advantage of an uninterrupted prosecution, through the year, of the business which at present is necessarily confined to eight or nine months; but will lay open to the vast trade of Albany, and the neighbouring country, a cheap outlet to the seacoast, while the navigation of the river is closed. Such a channel for this trade, to be kept permanently open, while the usual channel is closed three or four months every year, must be in every season, of great importance to the city of Albany, and to all who are concerned in the trade of the place, and in certain seasons, when a sudden foreign demand for flour and other produce, occasions a temporary rise in the price of these articles, its value would be immense.

If we consider the vast capital which in this state, and the other New England states, is already invested in manufacturing establishments, and the increasing portion of our industry, which if successfully employed, must hereafter be devoted to manufacturing pursuits—if we consider the extent of that fertile and growing country, which must re-

ceive its supplies of manufactured goods, and return its rich products to the seaboard, through the New York canals,—we cannot doubt that a very extensive trade must be carried on, between these two tracts of country, both so rich in resources, and so different in the nature of their products, and of their wants,—a trade immensely valuable to both parties, but more important perhaps to us, than to them. The trade already exists, though it is in its infancy; it is rapidly increasing, as we have shown; and it will continue to increase, even without additional facilities. But it cannot be doubted, that the advantages of a more rapid, direct, and permanent channel of intercourse will accelerate its increase. It is in our power, by providing at the present time such a channel for this trade, before it has become fixed by the habits of those engaged in it, in a more circuitous course, to secure the transport of it upon a Rail Road, which is greatly wanted for the purposes of the internal trade of our own state. It is only by providing this channel, at the present time, that we can rely upon this branch of trade, viz. that which arises from a demand in the western country for our manufactures, for affording support to a western Rail Road; for it will be too late, when a port out of this state shall have become the chief market for the sale of these manufactures, to induce the merchants of the west to come here to purchase.

2d. What is the amount of business of the country lying between Boston and Albany, which may be relied on for affording support to a rail road. This is a branch of our inquiry in which it is difficult to attain that degree of certainty which is desirable. In the absence of official documents showing the amount of this business, agents have been employed to visit most of the towns in the counties of

Berkshire, Franklin, Hampshire, Hampden and Worcester, and to procure on the spot, from the best sources of information, estimates of the amount of merchandise brought from the seaboard into each town, for the supply of the inhabitants; the amount of produce carried from each, to the seaboard; the amount of raw materials brought into each town, for the use of the manufacturing establishments; and the quantity of manufactured goods carried abroad.

By these means, and by adopting, in some cases, estimates made previously with the same objects, by committees or well informed individuals in the several towns, and communicated by them to a committee of the Legislature, of which Dr. Phelps was chairman, a return has been procured, from more than a hundred towns, in the five counties above named. On a careful examination of these estimates, we have reason to believe that some of them are too high, and others too low. It is perhaps probable that the aggregate may be too high, for the amount of transportation on the existing roads, at the very high rates of freight which are paid. Yet there is reason to believe, that they are not greatly exaggerated, and that they exhibit as accurate a view of the present amount of transportation as can be obtained. The general results for the County of Berkshire, are,

Imports from Albany, Hudson, Troy, and Hartford, of merchandise for consumption,	5,355	tons.
Do. raw materials for manufactures,	1,536	"
Exports, to places above named, of produce,	6,296	"
Do. of manufactures,	5,288	"
Total to and from 22 towns in Berk.	18,475	

In the returns which compose the above amount, Pittsfield, Richmond, Hancock, Windsor, Florida, Alford, and Mount Washington are not included. A portion of the transportation of the towns included in the returns, probably would not pass over the Rail Road, if it were built; but this amount may be presumed to be nearly counterbalanced, by that of the seven towns, from which there are no returns. The annual cost of transporting the above amount, at the prices stated in the returns, is $108,822, and the average cost $5,88 per ton.

For ten towns in Hampden County, the amount of transportation stated in the returns is 12,857 tons. This amount is conveyed principally to and from Hartford. From seven towns in this county there are no returns.

From fifteen towns in Hampshire County, the amount returned is 13,689 tons. This is principally to and from Hartford and Boston. The average cost of transportation to and from Boston is about $20. From three towns there are no returns.

The amount returned for ten towns in Franklin County, principally conveyed to Boston, is 4,929 tons. Ten towns are omitted. The average cost of transportation to Boston is about $20, and to Hartford about $5.

The amount for the County of Worcester is 27,951 tons conveyed between the several towns and Boston and Providence. This amount is taken partly from returns made in 1822, since which time there has been a considerable increase in the manufacturing towns. Although the proposed route passes through the central parts of the county, a deduction must be made, of perhaps one half, for that portion of the transportation which will not come upon the road. A sufficient deduction for

this cause, for the other counties, is supposed to be made, in the omission of any allowance, for the towns from which there are no returns. In supposing that an amount, equal to half that above stated, will come upon the Rail Road, from the business of Worcester County, it is presumed that the Blackstone Canal will be the means of increasing some branches of business upon the Rail Road, as well as of diminishing others. It will be perceived that the Canal will be the means of extending to Providence the line of communication opened by the Rail Road.

It would be taking much too narrow a view of the advantages of the Rail Road, to consider only the accommodation which it would afford to the present amount of business. It needs no argument to show, that many articles of the produce of the country, would be transported upon it, which are not now carried to market, because the cost of transportation exceeds their saleable value, when at the market. The interior of the state might send to Boston ship timber, which would command a high price, various other descriptions of timber, staves, firewood, charcoal, coal from the mine in Worcester, beef, pork, hay, potatoes, cider, apples, and other agricultural products. The demand for timber and firewood from the forests of the interior, would be unlimited. The extent to which ship-building will be carried on in this state, as well as other mechanic occupations, requiring large quantities of valuable timber, which these forests are adapted to supply, must always be in a great measure proportioned to the abundance of this supply. White oak timber is also in demand in Boston, at high prices, for other purposes. So also is white ash, birch, maple, and other kinds of tim-

ber, of which the western parts of the state afford an abundance. It is computed that 120,000 cords of firewood are consumed in this city, with the towns of Cambridge and Charlestown, annually, and the demand is every year increasing, with the increase of population, while the sources of supply are becoming drained. Of this amount more than 100,000 cords are brought by sea navigation, 9000 cords by the Middlesex canal, and the residue by land transportation from the neighboring towns. Nothing is included in the foregoing estimates, for timber, firewood, or any of the articles of agricultural produce above enumerated. Many of the towns export considerable quantities of cider brandy, but no cider nor apples, because the cost of transportation, by the existing means, would exceed their value. West Springfield sends 36,000 bushels of rye, annually, to Springfield, for distillation, but sends no grain to a distant market. Several other towns, raise large quantities of grain, which are exported only in the form of gin. There are consumed in Boston, Charlestown and Cambridge, annually, 7430 tons of hay, which is now derived from the neighboring towns, or is brought by water from the state of Maine. Large quantities would undoubtedly be brought on the rail road, a distance of many miles. The western counties produce potatoes in abundance, and of excellent quality, but they are entirely unknown in Boston, the cost of transporting them, being much greater than that of importing them from England. Other articles of agricultural produce would acquire from the rail road a new value, by being placed within the reach of a market, and would contribute to swell the amount of transportation. The fine building stone of Chester, as well as the marble of Berkshire

county, would probably be in demand for transportation to the north river, the granite of Palmer for use in the neighborhood of Connecticut river, and perhaps for transportation to New York; the soap stone of Middlefield, for transportation both to Boston and to Albany, and the produce of the exhaustless iron mines of Berkshire county, as well as the marble and lime of that county, for supplying the whole interior of the state. The iron castings of Brookfield, Lee, and Lenox, would come into more extensive use, other factories which have become dormant would revive, the numberless water privileges, on the several streams along the course of the road, would be brought into profitable occupation, and the springs of increased industry, which would be set in motion, would add to the uses, and consequently to the income of the rail road.

So also the quantity of imported articles would be augmented. The heavy productions of the sea coast, and of foreign countries would be carried into the interior, in much greater quantities. Coal, plaster, salt, fish, oil, foreign fruits, and many other articles, by being furnished much cheaper to the inhabitants of the inland counties, would be consumed in greater quantities. As the advantages of trade, and the free exchange of the productions of the inland parts of the state, for those of the sea, and of foreign countries would be much more fully enjoyed, the quantity of goods exchanged would be augmented, in some measure in proportion to the diminished cost of transportation.

3d. It remains to inquire what amount of transportation would come upon the rail road, from the trade of more remote places. Much of the trade of the eastern portion of Vermont has heretofore been

direct, by land with Boston. A considerable portion of this trade has been carried recently, by the channel of Connecticut river, to New York and Hartford, and the meditated improvements in the navigation of that river, will tend to carry it more exclusively in that direction. Another portion of it has been directed to New York, Albany and Troy, by means of the northern canal, and the improved roads across the Green Mountains. A rail road from Boston to any part of Connecticut river, would without doubt receive a portion of this trade, though it must be admitted that in striking the river at Springfield, it will be less commodious for this trade, than if it were carried in a more direct course towards Vermont. The same remarks will also apply to the trade of the part of New Hampshire, bordering on Connecticut river. The trade of Vermont and New Hampshire, ascending and descending the Connecticut river annually, was estimated several years ago, by persons interested in improving the navigation of the river, at 32,000 tons.

Another accession to the business of the rail road might be expected, from the western side of the Green Mountains. The produce of a fertile tract of country is now carried to Troy and New York, by a road which enters the state of New York at Pownal, a point which would be about as far distant from the rail road at Dalton, as from Troy. All articles of produce, for which there should be a better market at Boston than at New York, would easily be brought through that channel to Boston, and the productions of this part of the country, as well as of foreign countries, suited to the supply of that tract of country, could be carried thither in return, at nearly the same cost as from the city of New York.

From several portions of the state of Connecticut also, a considerable amount of trade may be expected, which will pass over this road. Not only those parts of that state which border on the counties of Worcester and Hampden, but those which are contiguous to the Connecticut river, and the Farmington canal, will find through the Rail Road the easiest access, both to Boston and to Albany. The facilities which it will afford them for a general trade with the former of those markets, and for obtaining supplies of flour and grain from the latter, cannot fail to attract a considerable portion of this business through this channel. Even some parts of the county of Litchfield, bordering on the county of Berkshire, would find perhaps the easiest access to a large market over this Rail Road. From the extensive iron works in Salisbury, 1500 tons of anchors for the government of the United States, are transported annually through Sheffield in this state, to the Hudson river. A portion of this and other transportation from that part of Connecticut, might be advantageously brought upon the Rail Road at West Stockbridge, and directed either towards Albany or towards Boston.

From these various sources out of the state, it is obvious a considerable accession of business to the rail road would arise, though it is difficult to form any precise estimate of its amount. It will probably not be thought too great an allowance, to put down 10,000 tons for the whole, from the three adjoining states.

The use which would be made of the rail road in the conveyance of passengers remains to be considered. There are now six distinct lines of stage coaches, on all which eighteen stages, exclusive of extra coaches, generally well loaded, run

run through from Boston to Albany, and return the same number of times, weekly. It is computed that they carry the average number of 50 passengers, both passages included, per day, or perhaps 45 per day, who would travel on the route selected for the rail road. To this may be added for the travelling to and from the intermediate places, what is equivalent to 30 passengers more, through the whole line, making in all 75 passengers a day, or 23,475 per annum. These at a toll of a cent a mile, or $2 for the whole distance, would pay toward the support of the road $46,950. It is impossible to estimate with any precision the increase of travelling which might be expected, from the introduction of so cheap, easy, safe, and rapid a mode of conveyance. It has been observed in many instances, that the reduction of stage fare to a low rate has been attended with a great increase of travelling. The same has been observed on steamboat lines. The cost of travelling on the rail road would probably be less, in proportion to the distance, than the usual permanent rate on any steamboat line; the whole route passes through a populous country; and it terminates, at both extremities, in places which are the resort of a vast number of travellers, both on business, and for pleasure. It is computed that the number of passengers, which arrive at, and depart from Albany, annually in steam boats, canal boats, and stages is 484,690. Four steam boats depart daily from Albany for New-York, often conveying 400 passengers. The travelling between those two cities, which was greatly increased by the introduction of steam navigation, has been increased in a much greater degree, by the reduction of the rates of fare, in the steam boats.

On these facts, principally, must rest the judgment that may be formed, of the amount of income which may be derived from such reasonable tolls, as may be levied on the transport of property and passengers on the rail road. The tolls, on the New-York, Farmington, and Blackstone canals, vary from one to three cents a ton. We have already suggested that sound policy would dictate a low rate of tolls for the rail road, as a measure likely to extend the uses of the road, and to produce the greatest income. It may however be useful to inquire, what amount of revenue might probably be derived from tolls, on the present amount of transportation, without any supposition of increase, and still without exceeding the medium rate on the New-York canals. The following table will show the amount which would be raised, on the transportation of the several quantities stated in the foregoing estimates, by a toll of half a cent a mile per ton, on property carried the whole distance between Boston and Albany, and at two cents a ton per mile, when carried on any part of the road, to or from any intermediate place. At this highest rate of tolls it is computed the cost of transportation would not exceed a fifth part of the customary freight, for inland transportation by wagons.

	Tons.	Miles.	Cents.	Amount.
Between Albany and Boston,	28,902	200	at 1-2	28,902
" Berkshire and Albany,*	13,855	40	" 2	11,084
" " and Boston,	4,618	150	" 2	13,855
" Hampden and Boston and Albany,	12,855	95	" 2	24,424
" Hampshire " " " "	13,689	95	" 2	26,009
" Franklin " " " "	4,929	95	" 2	9,365
" Worcester " " " "	14,000	40	" 2	11,200
" Vermont, Conn. &c. " " " "	10,000	95	" 2	19,000
	102,848			$143,839
Passengers, average through, 23,475,		200	" 1	46,950
				$190,789

Such is the result, without any allowance for the business of that part of Middlesex county, or of the state of New York, through which the route passes, on the supposition that the estimate of the present amount of transportation is correct. But it would be unsafe to rely with confidence, on an estimate of this kind, for entire accuracy. Yet it is probable, that if it were necessary to rely upon the present account of business for the whole support of the rail road, it might be raised on the actual amount of property transported, by the necessary increase of the rates of toll, above those here proposed, on such articles as would best admit of it.

But we would adopt a different mode of calculation, as better suited to the prospects of business, which would be opened by the construction of this road. The funds necessary for the work, may probably be obtained on the credit of the state, on loans for 15 or 20 years, at an interest of 4½ per cent, or at the farthest at 5 per cent. If we take 6 per cent, on the estimated cost of the road from Boston

* It is here supposed, that if the rail road should be made, a fourth part of the trade of Berkshire would be with Boston, and in the other parts of the table, that a portion of the trade of the other counties would be with Albany.

to Albany, to cover the interest together with the cost of repairs and superintendence, the amount will be something less than $200,000 per annum. With a reasonable assurance that about this sum may be annually raised from the income of the road, in the present state of the population and wealth of the country, there can be little doubt of the expediency of undertaking the work. The prospect of an increase of population, wealth, and business, will be a sufficient reserved fund, for paying off the principal of the debt, provided the business which will be done on the road, in the present state of the country, will be sufficient to pay the interest on the cost, together with all expenses of repairs, and of superintendence. In looking to the sources from which this immediate revenue may be raised, it is reasonable to take into consideration the new branches of business, which will be at once opened by the road. These are as certain, as the continuance of the present business, though their amount cannot be so accurately estimated. There will be little hazard, however, in assuming amounts, which may appear probable, and computing the income which would be derived therefrom by a low rate of toll, since, in case of a failure of the amount supposed, the deficiency may be made up, by an increase in the rates of toll.

The estimate which has been made of the transportation between Boston and the cities of Albany and Troy is 28,902 tons. It is admitted that all the estimates are to be received with some caution, though made on careful inquiry, by persons well qualified, and well situated, for coming at the truth. Yet it can hardly be deemed extravagant to assume this amount, with the addition of a third, for the quantity which will probably be transported on the project-

ed road, possessing as it will, the advantage of a continued business through a great part of the winter, when the main channel to the ocean is frozen up, and the other facilities which have been explained. The amount then supposed, will be 38,500 tons, at $1 per ton, for the whole distance. We will also suppose, that the additional transportation for Berkshire, from the increased amount of the produce of her quarries, mines, aggriculture, forests, and manufactures, which will be sent abroad, and of heavy articles which will be returned, will raise the estimate for that county to 16,000 tons, to and from Albany, and 5,000, to and from Boston. We will for the same reasons raise the estimate for Hampden and Hampshire to 15,000 tons each; for Franklin to 6,000; and for Worcester, the nearer position of which to Boston will afford greater advantages for the transport of timber and fire wood, to 25,000, with 2,000 to Albany. If we compute a toll on these amounts at a cent a mile, per ton, and suppose an increase of 100 per cent in the mumber of passengers, above the foregoing estimate, the produce will be as follows:

	Amount.	Miles.	Toll.	Produce.
Between Boston and Albany, ...	38,500	200	1-2	$38,500
" Berkshire and Albany, ...	16,000	40	1	6,400
" " and Boston, ...	5,000	150	1	7,500
" Hampden and Albany and Boston,	15,000	95	1	14,250
" Hampshire " " " "	15,000	95	1	14,250
" Franklin " " " "	6,000	95	1	5,700
" Worcester and Boston, ...	25,000	40	1	10,000
" " " Albany	2,000	150	1	3,000
" Vermont, N. H. and Conn. } and Boston & Albany,	10,000	95	1	9,000
Passengers, 46,950, ...			1	93,900
	133,500			$203,000

These amounts are not assumed with confidence, and it would perhaps be safe to assume a much lower amount. If we deduct one third, it will be

necessary to increase the tolls; and by doubling the rate on one half, embracing such articles as would best bear the increase, the same amount of income, above stated, would be obtained.

We have considered hitherto the uses of the proposed rail roads, with reference solely to the amount of income, which the travel upon them, will be likely to produce. If the results which we have endeavoured to exhibit as probable, can be relied upon, this great work may be accomplished at the expense of the state, without being ultimately any burden upon its finances, and with the prospect of affording in the income which will be derived from it, a full reimbursement of the cost, and a permanent source of revenue. But it is not chiefly as a measure of finance, that it recommends itself to the attention of the legislature, but for the substantial benefits which it offers to the public, in a facility of intercourse, a channel of extended business, and a bond of union, between distant portions of the state.

To reap the fruits of the soil and gather the gifts of nature, it is necessary that men should be scattered upon the face of the earth, but that they may enjoy the benefits of social and civilized life, the advantages of trade, and the improvements of the arts, they must have a facility of intercourse with one another. So essential is this ease of intercourse, that without it any great advance in the cultivation of the arts, or in wealth, is not to be expected; and it is almost in proportion to the perfection of the means of intercourse in a community, that its numbers, wealth and means of enjoyment increase. In the commodiousness of our sea ports, and the extent of our navigation, we possess the means of intercourse with other sea ports,

and foreign countries; but the trade which can be advantageously prosecuted abroad, must be limited in some measure by the number of those at home who share in its benefits, and nourish it by the fruits of their industry. The market for the import trade of the port of Boston, does not bear a due proportion to the extent of its navigation. This defect is owing principally to the want of an easy communication with the inland parts of the country, and to the numerous channels, by which the inhabitants of the interior find a readier access, to other sea ports. The tract of country, which at present can carry its surplus produce to Boston, more easily than to any other sea port, and which can receive its foreign supplies from thence most conveniently, contains a population not exceeding 300,000 souls. There are other portions of country, of which the trade centers principally in Boston, but it is from other causes than the greater ease of intercourse. Formerly, the circle of which Boston formed the commercial centre, was much larger, but it has been gradually narrowed by the diversion of business to other sea ports, until it is no longer the market which is most easily approached from the central parts of our own state. New York, by the power of steam navigation, is for all purposes of trade upon the very borders of the state. Providence and New York have, by means of the Blackstone canal, taken to themselves a large portion of the trade of Worcester county; Connecticut river and the Farmington canal carry to Hartford and New York the trade of the river counties; and the Hudson river takes the whole trade of Berkshire. It is very true, that with the advantages of capital, extensive shipping, nautical skill and enterprize, an extensive foreign trade may be carried on without

a great inland market for the import trade, and without much produce for export; but it is very certain, that under such circumstances the trade must be more limited and less profitable. It is true we may have an extensive coasting trade, subsidiary to that with foreign ports, but without more decisive advantages than the possession of capital, skill, and a convenient port, the trade of the place must be considered as held by a tenure in some degree uncertain. In the present state of the trade of the town, no symptoms of decay are apparent; on the contrary, there are abundant evidences of commercial prosperity, but it should be the policy of a wise community, to multiply the sources, and secure the permanency of their prosperity, by every means in their power. For these reasons it seems important for the commercial interests of the city of Boston, to open, if possible, such channels of communication, as will secure to her the trade of those portions of the country, at least, which have contributed to her present growth. The population of the tract of country, to which the proposed western rail road would afford the cheapest and most direct access from the sea coast, is nearly equal to that of the whole country, of which Boston is now the most convenient market. That the opening of such a channel of intercourse would produce some beneficial effect on the trade of this metropolis, no one can be so incredulous as to doubt. The degree of its influence, it is impossible to calculate. But this is certain, that only a slight accession to the trade of a place, or a slight diminution of it, from any permanent cause, must be sensibly felt, in its influence on the value of fixed property, and in the profits of many branches of business. There are in Boston costly dwellings, ware-houses, wharves,

and other property, the value of which is sensibly increased or diminished, with every fluctuation in the general trade of the town, and of which the value would be permanently enhanced, by any permanent accession to the trade of the place, from the opening of a new channel for it.

It is not only in the increase of its trade, that Boston would derive a benefit from an easier intercourse with the interior. The facility which would be thus afforded for obtaining supplies, in greater abundance and variety, would add essentially to its advantages, and would contribute to its growth. In these advantages, the neighbouring towns would ultimately, if not immediately participate, for it is manifest that whatever tends to increase the population, business, and wealth of the metropolis, is advantageous to the neighbouring country.

But the effect of this improvement, in adding to the value of property, would be by no means confined to the city of Boston. On the contrary, the ratio of benefit, compared with the present value of property, would probably be greatest to those parts of the country, through which the road would pass, which are remote from the capital. Until the introduction of rail roads, water conveyance has been the only mode of transportation, by which agricultural produce could be advantageously carried any considerable distance to a market. For this reason, this description of property, and consequently the land which produces it, is of much less value, when situated at a distance from a market, or from some channel of water conveyance, and the diminution of value is in proportion to the distance. Thus a farm in either of the western counties, unless situated near the Connecticut river, or one of the canals, or near some thriving manufacturing

town, is of less value, by near one half, than the same amount of land, of the same quality, situated within a few miles of Boston, or of navigable waters. By carrying a rail road through those counties, this difference would be in a great degree removed.

If proof of this fact were necessary, it might be found by reference to the official valuations, which are made every ten years, under the authority of the legislature, to serve as a basis for the apportionment of state taxes, between the several towns. In this valuation, an estimate is given of the quantity, and average amount of income, per acre, of each description of land, in every town in the state. It is not to be relied upon, as showing the precise quantity, or the actual value of the lands and income; but from the care and vigilance of the representatives of the several towns, to equalize the burden of taxation, as far as possible, it is to be presumed that the proportional value is ascertained, with a good degree of accuracy. The lands are evidently estimated too low, both in quantity and value, and therefore although this official valuation may show the ratio of difference in value, between lands situated near water communication, and at a distance from it, it presents a lower positive amount of difference, than exists in fact. The quantity of land returned in the valuation lists, under the heads of Tillage, Upland mowing, Pasture, Wood, and Unimproved lands, in the five western counties, is 1,689,465 acres. The value of these, computed from the income, of each description of land, as estimated in the valuation for each town, is $14,152,713. The value of the same quantity of the several descriptions of land, computed at a price equal to the average valuation of farming towns from 12 to 14 miles from Boston, of a soil

apparently not more productive at least, than the corresponding descriptions of land, in the interior and western parts of the State, would amount to $22,608,363. From this calculation it would appear that the valuation of the above quantity of lands, which is less by about a million of acres than the whole surface of the five western counties, would have been increased about eight and a half millions of dollars, if they had been so situated, as to be on a par in regard to advantages of communication, with lands of the same kind, 12 or 14 miles from Boston. The route proposed for the rail road passes within six miles of more than a million of acres of land capable of cultivation, all of which are situated more than twenty miles from either Boston or Albany. It will perhaps not be a rash inference from these facts, to suppose that the building of the rail road would produce an immediate rise, in the aggregate value of lands, and real estate, in the commonwealth, more than equal to its whole cost.

It may be suggested that such an increase, in the value of lands situated at a distance from the great markets, arising from the improved means of communication, would be attended with a diminution of the value of lands in this vicinity. If there were a limited amount of business and population to be supplied, such might in some degree be the case. But with the steady increase of population and business, in Boston and the vicinity, and the readiness with which that increase would be accelerated by every improvement in its advantages, either for business or for residence, it must be manifest that the prices, even of agricultural produce, cannot be materially, or for any length of time, reduced, by enlarging the field of supply. The demand is al-

ready so extensive, that the increase of supply must be very great, to be sensibly perceived; and the increase of supply, by being attended with an increase of other branches of business, will at the same time be accompanied by an increase of demand. No truth can be more unquestionable than that property in general, situated near a large town, which depends for much of its value, on its vicinity to that town, must rise or decline in value, with the rise or decline of the wealth and prosperity of the town. Upon this principle, the towns in the neighbourhood of Boston, must be considered as almost equally interested with Boston itself, in extending its means of business, and multiplying its sources of wealth.

There is another topic connected with this branch of the subject which deserves consideration. The industry of the people of this state is becoming every year, more and more, devoted to manufacturing employments. It is this exercise of the labour and skill of our population which must hereafter constitute our chief means of wealth. The extensive water powers in the state, yet unoccupied, and the advantages which we possess for manufacturing pursuits, compared with those of other parts of the union, will lead to a great extension of these branches of industry. For the convenient prosecution of these pursuits, there will probably at no remote period be established some central mart, to which most of these manufactures will be principally carried for sale, and to which purchasers, from among ourselves as well as from abroad, will resort to select their assortments. At this mart, whereever it may be, much of the wealth produced by the successful prosecution of manufactures will be concentrated. To have such a market centrally situ-

ated, and easily resorted to, will be beneficial to those who buy as well as to those who sell. It is very obvious, that it must be important to the interests of the state, to have this market seated at our own capital, or at least within the limits of our own state. But however convinced the public may be of this truth, it is by no means certain that it will be in their power to place it there. Those who have merchandise for sale, will send it where they are likely to find the greatest resort of purchasers, and the usage once established, of sending a large portion of our manufactures out of the state for sale, may make it necessary for other venders to follow the example, even when our own citizens are likely to be, in a considerable proportion, purchasers. To avoid this contingency, it is necessary to make it easy for purchasers, from all quarters where it is practicable, to resort to our own market. Many parts of the country, receiving large quantities of merchandise from the manufactories of this state, can at present most advantageously procure them through New York, or other ports out of the state. This affords an inducement to the manufacturer, to make those ports places of deposit and sale for his goods, in preference to a market within the state. Every inducement possible should be created, for rendering our own capital the preferable market. There can be no more effectual method of accomplishing this object than by establishing a cheap and regular method of transportation, directly from the capital of the state, to the parts of the country into which these manufactures are to be ultimately distributed. The western parts of the state, and the northern and western parts of New York, and even the western states, if a rail road were established from Boston to the Hudson river, might regularly receive supplies, to a large amount from

Boston, which without this improvement, will be necessarily sought from some other market. In this manner this improvement will have the effect of extending the benefits, and increasing the profits of the industry of our people.

Without some improvement of this kind, there are parts of the state where population must remain stationary, and where labour is expended with very little profit. There are manufactories established and conducted by enterprizing people, the profits of which are almost entirely exhausted, in the cost of transportation. To establishments thus situated, the benefit of a rail road would be immediate and obvious, and to others which are situated nearer to a general market, the ultimate benefit would be hardly less certain, from the consequent enlargement of that market.

In the selection of a route from Boston to the Hudson river, which will afford, at the least cost, the shortest and easiest communication between the extreme points, and also the greatest accommodation to the inhabitants of the intermediate country, an examination has been made of all the routes, which appear to offer any advantages for securing these objects. Three general routes presented themselves to the attention of the Directors, 1st. that which has been already described, as on the whole decidedly preferable to all others, it being in its general course the same which was partly surveyed under the direction of the Board of Commissioners, in the Autumn of 1827; 2d. a more northerly route, crossing the Connecticut river near Northampton; and 3d. one pursuing a still more northerly course, and passing through the vallies of Miller's, Deerfield, and Hoosac rivers to Troy. The two last named routes both appeared to possess

some claims to attention in preference to the first; the second as being more central, and the third as affording a more direct channel, for the trade of the tract of country, bordering on the upper parts of Connecticut river.

The Directors therefore caused such surveys to be made, as were necessary fully to test the facilities of these routes. They were already in possession of a thorough survey made by Loammi Baldwin, Esq. in the year 1825, of the channel of Miller's river, and of a northerly route, from the sources of this river in Ashburnham, to Boston, and also various trial surveys through Gardner and Westminster, and through Lancaster, Bolton, and other towns. From an examination of these surveys, it was found that in pursuing a route so far north as the direct course to Westminster, there was a considerable disadvantage, in the necessity of descending so low, as the channel of Nashua river at Lancaster, and then rising to so great an elevation as Westminster. With a view therefore of seeking a more regular ascent to the highlands, which bound the waters of Miller's river on the east, as well as towards the sources of Ware river, a survey was made through Waltham, Sudbury, and Boylston, to Princeton. By this route the summit of the ridge dividing the Atlantic waters from those of the Connecticut, was gained by a more gradual ascent, than by either of those previously investigated. From this summit a line was surveyed by Mr. Richard P. Morgan, under the directions of the board, through Hubbardston, to the line of Mr. L. Baldwin's survey in Templeton, thus completing with that survey, an entire line from Boston to the mouth of Miller's river, and extending with the survey of Gen. Hoyt, made in 1825, to the summit of Hoosac mountain.

The line of the survey was also continued from Princeton down the Ware river in the most practicable direction towards Northampton. It was found necessary to follow the course of this river, to near its junction with the Chickopee and Swift rivers, and by this circuit the distance was prolonged far beyond what had been anticipated. The distance by this route to Rock ferry on Connecticut river, three or four miles from Northampton was found to be 106 miles—or 12 miles farther than by the southern route to Springfield. On the west side of Connecticut river also, there appear to be almost insuperable obstacles to the extension of this line in the direction of the Hudson. It would be necessary either to proceed in the direction of Westhampton and Norwich, to join the southern route at Chester, in which case a summit must be passed requiring a descent of 563 feet, to reach the same point, which by the southern route is gained by a gradual ascent, and without any descent beyond Connecticut river; or to proceed in a north westerly direction, through Savoy to the Hoosac river, in which case a height must be passed 463 feet greater than that passed by the southern route, and presenting a very steep and difficult descent on the westerly side. It was ascertained also, that if it were attempted to proceed, in any direction, towards Albany or Troy, from the Deerfield river, an equal if not a greater elevation must be passed, with a very steep inclination on both sides of the ridge.

As however the channel of the Hoosac river appeared to present a favourable route towards Troy, which if found to possess decided advantages, might be united either with the northern, middle or southern route, it was concluded to make a survey of that route, beginning from the southern line in Dalton, and ending at the boundary line between

the states of New York and Vermont, it being understood that the remainder of the line to Troy, would be surveyed, under the direction of the Commissioners of the State of New York. The part of the line within the State of New York, proved to be less favourable than was anticipated. It was found necessary to leave the valley of the Hoosac river, and to pass ground rising more than 400 feet above the level of that river. This result seemed to render it unnccessary to make any further surveys on the Northern route, it being manifest, that no facilities yet to be discovered, could compensate for the disadvantage, of so much greater elevation on the three summits.

On comparing the three lines, it is found that by the southern, the distance from Boston to Albany is 198 miles, and the elevation of theWorcester ridge 918 feet, the height of the Berkshire ridge above the Conneticut river at the place of crossing 1440 feet, and that of the ridge west of the Housatonic river 166 feet above that river.

By the middle route, the distance to Troy is about 210 miles, the height of the Worcester ridge at Princeton 967 feet, that of the Berkshire ridge at Savoy, 1903 above the Connecticut at the place of crossing, and that of the New York ridge 414 feet above the point of departure from the Hoosac river.

By the northern route, the distance is about 190 miles, the height of the Worcester ridge, if crossed at Hubbardston is 1051 feet, and if at Westminster by the route through Lancaster 1081 feet, that of the Berkshire ridge, in Florida or Savoy is 1886 feet above the Connecticut at the place of crossing, and that of the New York ridge 414 feet.

In this estimate, the minor undulations, which

may be supposed to be about equal, in the several routes, are not taken into the account. If we double the amount of these several elevations, so as to embrace the descent, the change of level on the southern route will be found to be 1520 feet less than on the middle, and 1654 less than on the Northern. Should either of the two latter routes be adopted, the application of stationary powers for passing the Berkshire ridge would become indispensable, and without any saving of distance from that above stated, while on the contrary, by adopting stationary powers, to a much less extent, on the southern route, a saving might probably be made of ten or twelve miles, and without exceeding, in the amount of stationary power, that which would be saved in locomotive power.

It being thus ascertained, that the southern route affords the greatest facilities for the construction of the road, it was deemed important to inquire whether it would afford equal accommodation with either of the others, to the trade of the intermediate country, between Boston and Albany. On this point also the result was in favour of the Southern route. The population of the towns through which it passes, according to the last census is 73,632, and if we add that of the towns west of Middlesex county, within ten miles of the route 137,175. The population of the towns which the northern route passes through, is 57,526, and if we add that of the towns within ten miles of the route, the number is 115,892. The Nothern route would be more convenient for accommodating the trade of a part of New Hampshire and Vermont, and the north eastern parts of New York, but the southern has the advantage of accommodating the country bordering on the Blackstone Canal (through which a communication will

be found with Providence,) some parts of Connecticut, with the country on the lower parts of Connecticut river, and the Farmington, and Hampshire and Hampden Canals, and of terminating at Albany, the great depot of the Western trade, and the central resort of travellers on the North River. There is some probability also, that by selecting a course from the line of this state to the Hudson river, more direct than either of those yet surveyed, a branch rail road may be advantageously made, terminating at Troy. This route is also favourably situated for receiving either by rail roads branching from it, or by common roads, the trade of an extensive tract of country, including that through which the middle route passes, and indeed nearly the whole of the central and western parts of the State. The obstacles presented by the Worcester ridge of highlands being once surmounted, the rail road may be easily approached by level roads, through the vallies, which run at right angles to it. It runs but a short distance from the valley of Ware river; at Brookfield it is within 5 miles of the village of Ware; and at Ludlow, within 11 miles of Rock Ferry, near Northampton. To these points, branch rail roads might be constructed at a moderate expense. At Springfield, it may receive produce from boats, and convey it to Boston, cheaper than it can be brought by water, or carried to New York. If it touched the river only at Northampton or Deerfield, the trade of the lower parts of the river would be in a great measure lost to it. So also, if it pursued the northern route, would be a great part of the trade of Berkshire county.

For these reasons, the general course of the line on which the estimates have been made, seems entitled to a decided preference. Before coming to

a decision on the western termination of the line, a committee of the Board of Directors proceeded to Albany, and had a conference with the Commissioner of the State of New York, and examined with them, the plans of the surveys made by their engineer, as well as those made by the engineer of this board. By direction of those commissioners also, their engineer, Mr. Young, came to Boston and exhibited to the Directors the plans and profiles of his surveys of three routes, one from Albany, and another from Hudson to the line of this state, at West Stockbridge, and a third from Troy, to the western line of Vermont at Pownal. On a full examination of these plans, with the explanations made by the engineer, the directors came to an unanimous decision, that in their opinion the route to Albany was to be preferred. Their vote expressing this opinion was communicated by them to the commissioners of the state of New York.

The Directors desirous of leaving no route unexplored which offered any probability of superior advantages, and impressed with the importance of discovering the most level route, from Boston to the Connecticut river, employed Mr. Morgan to make a survey of a line diverging from the main southern route, and passing through the southerly parts of the county of Worcester. This line departs from the other at Grafton, and after passing through the towns of Millbury, Ward, Oxford, Dudley, and part of Thompson in Connecticut, Southbridge, Sturbridge, and Brimfield, returns to the main route at Palmer. It proved as was anticipated, to have a less elevation than the more direct line, but the increased distance is much too great to be compensated by the diminished elevation. The length of this line is 49 miles 23 chains and 86 links, or 12

miles 42 chains and 95 links greater than the distance from the point of beginning, to the point of termination, by the line surveyed by Mr. Baldwin. So great a prolongation of the line, would defeat the purpose of suiting it to the conveyance of passengers, it would greatly increase the expense of construction, and the saving of travelling power which would be made, by its passing a more level surface, would not be equal to the increased power required, by prolonging the distance.

An attempt was also made to discover a practicable route more direct than that surveyed by Mr. Baldwin, from Newton to Westborough, and Mr. Wadsworth was employed to survey a line from Newton through the towns of Weston, East Sudbury, Framingham, and Southborough. This line, though shorter than the other by 54 chains and 27 links, presents much greater inclinations, and on this account is less advantageous. The steepness of the ascent from the valley of Charles river, the height of the summit in Weston, and the steep inclinations in Framingham and Southborough, would not only make the graduating of the road more expensive, but would render the best surface which could be formed, much less favourable than that on the other line. A second line was also surveyed by Mr. Baldwin, between Boston and Needham, which proved to be longer than the first, without any advantage in the profile, to compensate for the increased distance.

A survey was also made by Mr. Baldwin, of a route extending from a point on the former survey near the boundary line of New York, through West Stockbridge and Stockbridge, to the Housatonick river, and along the valley of that river, through Lee, Lenox and Pittsfield. This line has the ad-

vantage of being more level than the route through Richmond, but it is too circuitous to be adopted. The first part of it, however, through West Stockbridge, Stockbridge, and South Lee, is in a direction extremely favourable for the extension of the line through Becket, and thereby materially shortening the route, provided on further examination, it should be found preferable, to adopt a system of stationary powers, for passing the heights, which on this line, are too steep to be surmounted by locomotive power alone. A part of this line only has been surveyed, viz. from its summit in Becket, to its junction with the Housatonick line in Lee. It was found that more time would be required in selecting the best direction, making the surveys, and the necessary estimates and calculations for the most favourable construction of the road, by the application of stationary powers, than could be devoted to this object, before the close of the season. The summit in Becket was found to be 240 feet higher than that on the Pittsfield route in Washington. Further inquiries will be necessary to determine whether a lower summit may be found by adopting a different course, and also to determine whether this route may be most advantageously united with the other, by following the channel of Walker brook, from Becket to Henry's tavern, or by a more southerly course through Otis and Blanford. The direction of this route, as far as it was surveyed, will be seen on reference to the plan, and its character is explained in the engineer's report. The curves in the line of the survey, are such as were found necessary, for reducing the inclination to so low a rate as 80 feet in a mile. Steeper inclinations would admit of its being carried in a more direct course.

Plans of all the surveys made by Mr. Baldwin, Mr. Morgan, and Mr. Wadsworth, on a scale of four inches to a mile, and profiles showing the variations of the surface of the ground, on a scale of eight inches to a mile for the distance, and an inch to each forty feet for the elevation, have been drawn by them respectively, and accompany their reports.

Since the appointment of this board, the surveys for the Providence route have been thoroughly prosecuted, with a purpose of ascertaining the line, which shall combine the advantages, of the shortest distance, the most favourable surface, and the least expense of construction. It seemed to be not only a reasonable compliance with the wishes of the inhabitants, immediately interested in the selection of the line, but the only method of insuring the best location of the road, to direct a survey of all the routes, which, on a careful examination, offered any reasonable prospect of a better line, than those already surveyed. The results of these various surveys are stated in the report of the Engineer, and more clearly exhibited in the plan and profiles, which accompany his report. On a comparison of these results, the directors had no difficulty in selecting two general routes, to the exclusion of all others; but before deciding between these two they requested the engineer to lay out the line of road upon both, in such manner as to indicate the most favourable rates of inclination practicable, at a reasonable cost, and to make full estimates of the cost of construction upon each of them. These estimates with tables showing the rates of inclination upon the two lines, are annexed to the engineer's report. The routes are denominated by him the *Middle*, and the *New Eastern* routes.

It is found from these estimates that the Middle

route admits of the construction of a rail road at the least cost, and on a line nearest to a level. It is also two chains shorter than the New Eastern route. It begins in Boston, either at the most southerly wharf on Front street, near which place it crosses Washington street, near South Boston bridge, or at the junction of Boylston and Charles streets near the Common, and proceeds on the west side of Boston neck to Wait's Mill in Roxbury, and thence through Roxbury, the west part of Dorchester, the east part of Dedham, the middle of Walpole and Foxborough, a corner of Mansfield and Attleborough city, to Pawtucket; it crosses Pawtucket river near Central Falls, proceeds through the east part of Providence to India Point in the south part of Providence, and may be extended to Fox Point, the lower termination of Water street, on Providence river. Or, instead of crossing Pawtucket river at Central Falls, the line may be carried down on the Massachusetts side of the river, to India bridge, and there terminate; or be carried across the river near India bridge, to India Point, and thence to Fox Point. The distance from Front street in Boston to Fox Point in Providence, by way of India bridge, is 43 miles and 48 chains; the estimated cost of construction, for a single road is $334,400 25, and for a double road, $649,513 48. The greatest rate of inclination on any part of this route, if graduated in the same manner assumed for this estimate of cost, would be thirty feet in a mile. If the road should terminate at India bridge, its length would be 42 miles 69 chains, and the estimates of cost, for the single road $321,826 82, and for the double road $698,134 71. If the line be made to cross the Pawtucket river at Central Falls, the distance from Front street to Fox Point,

will be 43 miles 37 chains, and the estimate of cost for the single road $334,667 35, and for the double road $654,444 63. The inclination of the road, in this case, for about five miles from Fox Point, will be from 40 to 50 feet per mile. By admitting an inclination of 40 or 50 feet on several other short sections of the route, instead of 30 feet which is the basis of the estimates, a reduction from the above estimate of cost might be made, equal to 20 or 30,000 dollars for the single road, and a proportional reduction for the double road.

The new Eastern route departs from the same points in Boston, as the other, and after following the same course, through Roxbury and the west part of Dorchester, to near Mother Brook, there takes a more easterly direction, crosses this Brook and Neponset river near their junction, proceeds through Canton, passing near the stone factory, Sharon, and a part of Foxborough, and after meeting the other route at Wading river, may terminate at either of the points mentioned in the description of that route. This line differs in length from the other, if the same termini are adopted, very little. But it is not capable of being graduated to so near a level, and the cost of construction, even with greater inclinations, will be greater. About a mile and a half must be made with an inclination of 80 feet in a mile, more than another mile must have an inclination of 50 feet, and another half mile an inclination at the rate of 36 feet. The aggregate ascent and descent is 116 feet greater, being 995 feet, if terminated at Fox Point after passing Central Falls. The amount of ascent and descent on the middle route, with the same termination, and passing Central Falls, is 879 feet. The estimated cost of construction, for a single road is greater, by

$31,526 93, and for a double road, by $64,363 51, than that of the middle route.

If, therefore, we regard only the cost of making the road, and the facility of travelling upon it between Providence and Boston, the middle route is entitled to a decided preference. But the amount of transportation to and from the intermediate places, and of business which would be accommodated by the road, is perhaps somewhat greater on the New Eastern than on the middle route. It is also nearly on the best and most direct route, for about half the distance, to Taunton, a place of extensive business and one requiring a constant communication with the capital. A number of persons also in Canton have offered to contribute about ten thousand dollars towards defraying the additional expense, in case the Eastern route should be adopted. These considerations are entitled to great weight, yet the business which would be accommodated by this route, does not appear to be so much greater, than that which would be aided by the western route, as to justify the departure from the line which admits of a road so much more level, and at a cost so much less.

Besides the selection of the best general direction for the road, several questions of some difficulty have presented themselves, in the choice of the best route for entering the town of Providence and also the best termination in the city of Boston. The most direct approach to the central parts of Providence, would be through the northerly parts of the town. But the ground in that part of the town was found too high to be passed with ease, and the difficulty of carrying the road through the settled parts of the town, unless by incurring a very great expense in the removal of buildings, would probably render it necessary to termi-

nate it at a considerable distance from navigable waters. For these reasons an entrance to the southerly part of the town has seemed the most practicable, and likely to be most convenient for approaching the places of extensive business, unless some other mode should be pointed out, for entering by the northern part, than has yet been suggested. Fox Point, the place which has been designated as a convenient termination for the road, is easily accessible, and the land to be passed over, might probably be obtained at a moderate expense. It is also near the deepest waters of the harbour, and but a short distance from the wharves where most of the shipping discharge their cargoes. If any difficulty should be found in extending the road to this point, it might be terminated at India Point, which is also near deep water, where ships are sometimes discharged, but it would be less commodious for the general trade of the place, because more remote from the central parts of the town. By a termination at India Bridge on the Massachusetts side of the river, the expense of a bridge, and of extending the road in the town of Providence, would be saved, but the accommodation would be much less complete. The distance from this termination, by the present bridge to the Providence market in the centre of the town, is a mile and a half.

In proposing a point for the termination of the road in Boston, it has been supposed, that it would be desirable to bring it near to some navigable part of the harbour. It was therefore thought, that some part of South Boston might afford a convenient termination, if the eastern route through Dorchester had admitted of as easy a construction of the road, as that which has been described. For the

purpose of testing the facilities of this route, an estimate has been made of the cost of construction upon it, with a plan of the easiest practicable inclinations of the road. It is found, that the distance from the point of divergence to the new bridge in South Boston is 25 chains greater, than by the other route to Front Street; the cost of construction will be greater by $11,120 57, for the single road, and $21,290 13, for the double road; and the aggregate of ascents and descents is 120 feet greater. These differences in the distance, cost of construction, and level, give a decided preference to the route through Roxbury. Indeed this latter route leaves little to be desired, in point of level and directness, as the line is but a few chains longer than if it were straight, and the average inclination is less than 12 feet in a mile. It also admits of being terminated at any point which may be found most convenient, on Front Street, or on any part of the west side of Boston Neck, between the Roxbury line and Charles Street.

It has been thought inexpedient to make any more positive designation of the point of termination for the road, either in Boston or in Providence, because a final designation should be made, only after very full consideration, and on consultation with the authorities of the respective towns, to ascertain in what manner the location of the road, as well as the other interests of the inhabitants may be best accommodated. Considerable tracts of land will be necessary, not only for the course of the road but to afford room for the convenient disposition of carriages, and for depots of merchandise. It would be therefore injudicious to pronounce what lands would be necessary, or most convenient, until it shall be ascertained on what terms they may be

procured. These facts can be ascertained only by agents authorised to purchase. Fortunately the nature of the ground admits of so much latitude in the choice, that there is reason to believe that all the necessary lands may be obtained at a fair valuation.

It may be remarked also, that although much time has been expended in the selection of routes and in making surveys for testing their general character, another more careful and deliberate survey of the route selected will be necessary, before the precise line can be designated. In the final selection, regard must be had, not only to the facilities for the construction of the road, but to the accommodation which may be afforded to the inhabitants of the towns passed through, to the injury which would result, in each particular location, to the lands or other property of individuals, or to the public roads crossing the route, and to the ratio of damage in each case, requiring compensation. An investigation of all these details, would be quite superfluous before it is determined whether any rail road shall be made or not.

For the purpose of ascertaining the amount of transportation between Boston and Providence, and between each, and the intermediate towns, an agent was employed to visit the several towns, and to procure all the information which could be obtained for making an estimate. From the results of this inquiry it appears that the present annual amount of transportation, between

		Tons.
Providence and Pawtucket,	and Boston, by wagons is	1,706
Providence and Boston by water,		3,400
Boston and towns on the route more than 10 miles from Boston,		6,744

	Tons.
Providence, and towns on the route, more than 10 miles distant,	976
Boston, and towns not on the route, of which the travel would conveniently pass, 10 miles or more, on the route,	10,701
Providence, and do.	3,663
	27,190
Passengers in 1827, by the Citizens' and Commercial Lines of Stages, between Providence and Boston,	24,100

Providence formerly, when much smaller than at present, carried on an extensive trade with Boston. At present her commercial relations, in consequence of the cheapness and regularity of water communication with New York, are almost exclusively with that city. By reducing the cost of transportation to Boston, as low as the freight to New York, as by means of a rail road it undoubtedly might be, there is reason to believe that a portion of the trade between that town and this, would be revived. As a means also, of forming with the steam boats which navigate the sound, a line of regular transportation between New York and Boston, the rail road would without doubt receive a considerable amount of freight, which is now carried by the packets between the two cities. On the prospect of the increase of transportation from these two sources, and on the use of the road for the conveyance of passengers, must rest in a great measure the expectations of a sufficient income, to reimburse the cost of a rail road on this route. The cost of a single rail road, according to the estimate of the engineer, with the addition of 10 per cent for contingencies, and the superintendence of the work, would be something less than $400,000. To cover the

interest on this sum, together with the cost of repairs and superintendence, would require the annual income of $24,000. Half this amount might be raised by a toll of 50 cents each, on passengers, without supposing any increase of the number. On an amount of property, equal to that now transported on the line, including that carried by water, paying a low rate of tolls, perhaps $8000 might be received. A moderate increase in the transportation of property and of passengers, would be sufficient to raise the annual receipts above the estimate of annual charges.

By the act of the Legislature which prescribes the duties of the Directors, they are authorized to receive gifts and grants of land in the name of the State, over which the rail road may pass, and also of money or materials which individuals or incorporated bodies may offer, to aid in building the proposed rail road. In pursuance of this authority, they prepared the form of an instrument, by which conveyances of land for the several roads and releases of damages which might be occasioned by them, might be made, and employed an agent to visit the proprietors of lands through which the principal Providence routes would pass. On a great part of the line, the owners of lands which it will be necessary to pass, manifested a readiness to wave all claim to compensation, and on about half the line, conveyances or releases, for the purpose of the rail road, are executed by the proprietors. On the western route the same disposition has been manifested, but an application for written releases has met with little success, on account of the line not being definitely fixed. Assurances have been given by many individuals interested, that no compensation, for the lands over which the rail road will pass, or for damages, will be demanded.

The principles on which the estimates for the roads are made, are so clearly stated in the reports of the engineers, that they need no explanation. These reports are believed to be entitled to great confidence, from the care with which the surveys and calculations have been made, and the judgment and skill which the engineers have exhibited in the whole course of their arduous duty. It has been the endeavour of the directors, not only to adopt a mode of construction, which shall most effectually accomplish the objects in view, and be the most secure against accidents and decay, but to have all the estimates of cost made on principles which may be relied upon, as covering all the expenditures which will be likely to occur. The estimates are necessarily made on the lines surveyed. There is reason to believe a more deliberate examination for the final location of the road, will lead to many amendments of the several lines, by which material savings may be made in the cost of constructing the roads, as well as improvements in the course of them. It is obvious that no change need be made, unless where it can be done with advantage, either by reducing the cost, or improving the road.

No estimate has been made by the engineers of the annual cost of repairs, and superintendence of the road, after it shall be completed. From the durable nature of the materials of which it is proposed to build it, and the solidity of its construction, it is thought that expensive repairs will not be required, and that from one to one and a half per cent. per annum on the first cost will be a sufficient permanent allowance to cover these items of expenditure. Before the road shall become solid, some greater cost for repairs, may probably be required. In the original construction, it may be thought necessary, for avoiding the inconvenience of a settling of those parts of the road which consist of

high embankments, to lay temporary wooden rails, to serve for use, until the foundation becomes sufficiently solid, to maintain the rail stones immoveably in their places.

It has been the endeavour of the Engineers, to guard by means of drains, culverts, and walls, provided for in the estimates, against heavy damage from rains and thaws, though injury to a limited extent may be expected from these causes, especially before the embankments have become hardened by time.

The advantages of the rail road over a canal, or internal navigation of any kind, from the liability of the latter modes of conveyance to be obstructed by frost, have been alluded to. It is, however, not to be lost sight of, that the rail road is liable to temporary obstructions, especially on the mountainous parts of the route, by snow. A light snow, as has been found by experience on the Quincy rail road, affords very little impediment to its use. During the two last winters no snow has fallen of sufficient depth upon that road, to interrupt the regular, and convenient use of it. The rails being elevated several inches above the surface of the ground, it is found easy, when the snow is light, by placing two planks meeting at an angle in front of a heavy carriage, drawn by a number of horses if necessary, to clear the tracks of the loose snow, and leave them in a condition to be travelled with ease. In this way the road may be sufficiently cleared, at little cost, of snow when it is of a moderate depth, and not much drifted; and even when it is of considerable depth, the road may be kept open, by such exertions as are usually made, in keeping open the public roads of the country. But after such snow storms as frequently occur, covering the ground to a great depth, the travelling of the road will be necessarily interrupted. The period of this interrup-

tion however, will be always much shorter than that in which canals are frozen up; and as the rails on which the carriages travel will be supported by substantial walls, not liable to be acted upon by the frost, if the horse path is properly gravelled, the travelling in the opening of the spring, when common roads are almost impassable by heavy loads, will be as easy as at any season of the year.

It is a question which has engaged the serious attention of the Directors, whether they should recommend the construction of a single or a double pair of tracks, for each of the proposed routes. To avoid the obstructions which would otherwise occur, in the meeting of carriages passing in opposite directions, or travelling with different degrees of speed, it was thought that it would be necessary, either to adopt upon a single road the expedient suggested by an ingenious engineer of this city, of regulating the travelling at only two rates of speed, and fixing stated hours of departure from each point of the road, so that all carriages which would have occasion to pass one another would meet at places provided on the road, at regular intervals; or to adopt a double road, one for the travelling in one direction, and the other in the opposite direction, with sidelings at short intervals, for passing from one road to the other. On mature consideration, it was determined by the Directors to recommend the double road for the western route, and the single road for the Providence route. They have been led to make this distinction, by the consideration, that the line of the Providence road being shorter, is thought to admit with less difficulty, of the necessary regulation of the travel for the single road, and that the amount of transportation on that route, in the present state of business, is less adequate to afford a sufficient income for reimbursing

the expense of the double road. The cost of the double road would be nearly twice that of a single one. The sidelings on the single road would be more expensive than those of the double road, but on the supposition that the travelling will be regulated, their number will be much less. It being thought desirable to obviate the objections, which are made to the restraints which would be required for travelling on the single road, and it being estimated that the business of the western route will be sufficient to authorise the expense of a double road, the estimates on this route have been made for this description of road.

Surveys have been made, under the direction of Commissioners appointed by the executive of the state of New York, in pursuance of the provisions of the act of the legislature referred to in a former report of this board, for the purpose of enabling the legislature, to decide on the expediency, of constructing at the expense of that state, such part of the rail road between Boston and the Hudson river, as shall fall within its limits. We cannot anticipate what will be the decision of that Honorable body on the question. Considerations of great weight arising from the obvious utility of such a rail road to the citizens of New York, will undoubtedly be presented to their attention. Should they decide to unite with us in the prosecution of the work, the portion of the expense which would devolve on this state would be reduced about one fifth part, in which case the state of New York would be entitled to the income to be derived from the part of the road within that state.

It remains to comply with that injunction of the law constituting this board, which requires them to report "whether the said roads should be constructed by the state alone, whether in part by the

state, and in part by individuals or incorporations, or whether by the latter alone; and on what terms and conditions the means necessary for the construction of the said roads may be best provided." It is the opinion of the Directors that works of such magnitude, and on which the public accommodation so essentially depends, should be under the control of the government of the State. To enlist in such works the enterprise of individuals or corporations, it will be necessary to make a grant of privileges, which it will be difficult to define with sufficient limitations, to secure all the interests of the public, while at the same time they are made broad enough to induce a sufficient investment of capital for the enterprise. They therefore recommend that the construction of these works shall be undertaken on behalf of the state, under such a system of management as the legislature in their wisdom may direct, that an authority be given for raising such sums of money as may be necessary for the works, by the sale of stocks bearing an interest of 4 1-2 per cent. per annum, and reimbursible in not less than fifteen or twenty years, for the payment of which the faith of the state shall be pledged, and for meeting the annual interest of which sufficient taxes shall be provided. It is believed that stocks of this description to the amount which would be required for this work, might be sold at par or very nearly at that rate, and that before the whole sum would be required, a considerable income would be derived, from the part of the road which would be completed. The burden which such an appropriation would impose, on the finances of the state, would be easily met by the levying of a moderate tax, in addition to the present resources of the government. The expenditure of

so large a sum of money in the country, in compensation of the labour required in the construction of the road, will serve as a useful stimulus to industry, which will be felt far beyond the individuals employed in the work.

In undertaking a work of this kind, the state of Massachusetts would be but following the example of all her sister states, of equal resources. The state of New-York has added greatly to the numbers, and to the wealth of her citizens, by a system of canals, the cost of which has exceeded more than three-fold, that of the works here proposed. Pennsylvania has now in the progress of execution, a system of internal improvements, consisting of canals and rail-roads, much more extensive than would be necessary for accomplishing all the objects of an easy intercourse in this Commonwealth, and has already expended in these works a larger sum than it is proposed to raise in this state. Maryland, by the joint efforts of the state, of the city of Baltimore, and of individuals, has undertaken the gigantic project, of building a rail-road from the capital of the state, crossing the Alleghany Mountains to the Ohio River—a project much more difficult than that proposed in this state, from the greater distance to be traversed, the greater obstacles to be surmounted, and the inferior supply of materials. Virginia, North Carolina, South Carolina and Georgia, have expended large sums for internal improvements, in a country of much less dense population, and under circumstances believed to be less favorable for success, than are presented in this state, where an industrious, ingenious, and in some parts, (with their present means of obtaining a subsistence,) redundant population, are ready to take advantage of every facility, for extending their own resources, and those of the State. Ohio, a state yet in her

infancy, and far inferior to this state in the possession of capital, and means for the execution of a public work of this nature, has already raised more than two millions of dollars, for the construction of a canal, traversing the whole length of the State.

These examples, although they afford no apology for undertaking a work of doubtful utility, may well excite us to a careful inquiry into the means of improving our own advantages, and must teach us, that if we would keep pace with our sister states in those improvements, which elevate the character of the community, and multiply the resources and enjoyments of its members, some united effort is required of us. The condition of the people of this country cannot remain stationary. Those who are not positively advancing, are comparatively retrograding. The welfare of all parts of the state, is promoted or impaired, in a great degree, by the same causes. If we would have a great, populous and wealthy Commonwealth, we must have a populous and wealthy capital, which shall be a centre of life, action and energy to the state. If we would have a great and flourishing capital, we must have an extensive, populous, and rich surrounding country, bound to it by the tie of common interest, as well as common feeling, and connected with it by the means of easy and constant communication. Such means of communication, it is believed may be afforded by the rail roads now proposed.

The Directors therefore respectfully recommend to the legislature to adopt measures for the construction of rail roads on the general routes to Albany and to Providence which have been pointed out, leaving the precise location to be selected by the persons who shall be entrusted with the execution of the work. As however the execution of the whole of these works would necessarily occupy a

period of three or four years, and as a much safer judgment may be formed, of the cost and usefulness of the work, and of the comparative advantages of the mode of construction here recommended, after an experiment shall have been made on a part of one of the proposed routes, it is recommended that the operations of the first year shall be principally limited to the eastern section of the western route, and that such portion of the route only, beginning from Boston, shall be undertaken within the year, as it may be thought will be nearly completed. In pursuance of these views they recommend, that a board of competent individuals be formed, with authority, subject at all times to the control of the legislature, to employ the necessary engineers and agents, and take all necessary measures, for constructing the aforesaid rail-roads to Albany and to Providence, and to raise the necessary sums of money from time to time, by loans in the name of the state, on stocks bearing 4 1-2 per cent. interest, payable quarterly, and reimbursible at any term from 15 to 20 years at their discretion.

All which is respectfully submitted.

LEVI LINCOLN,
NATHAN HALE,
STEPHEN WHITE,
DAVID HENSHAW,
THOMAS W. WARD,
ROYAL MAKEPEACE,
GEORGE BOND,
WILLIAM FOSTER,
EDWARD H. ROBBINS, JR.

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FOR A

OAD

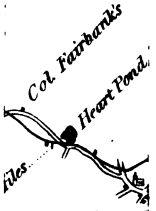
the Board of Directors

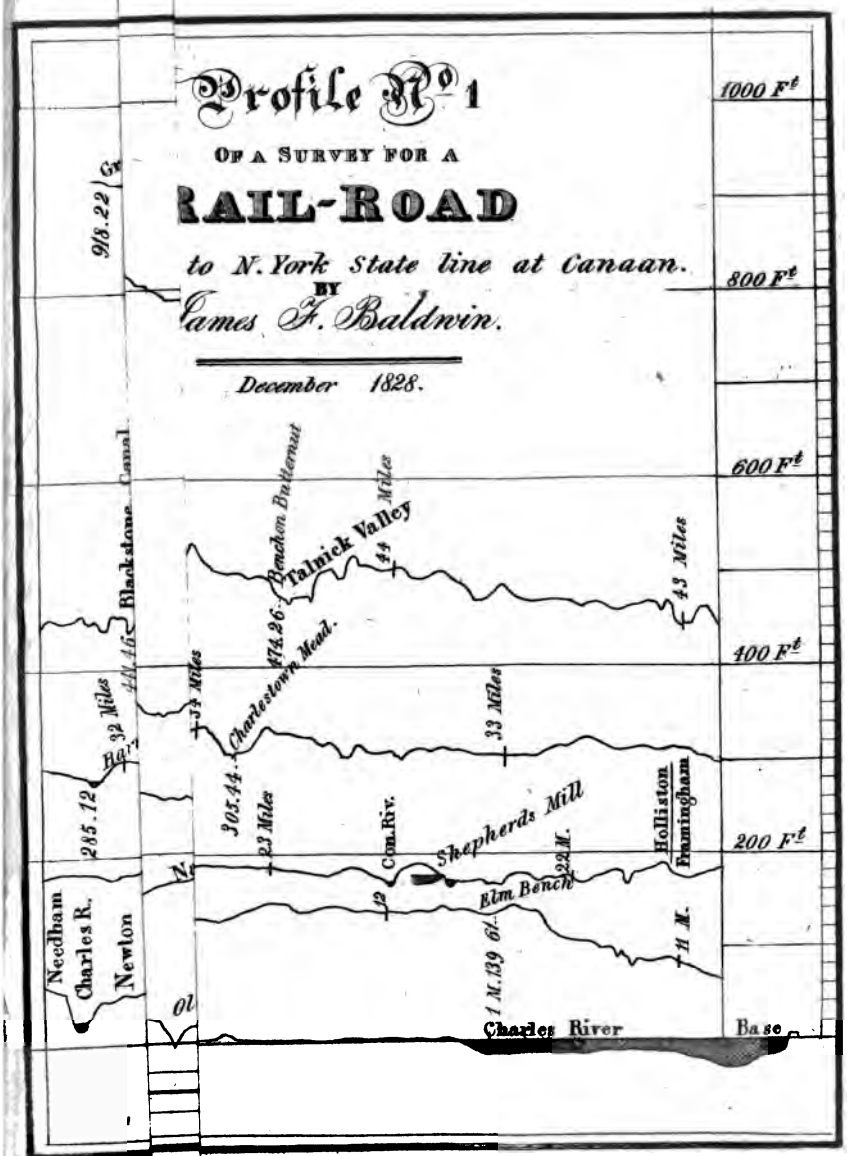
vements

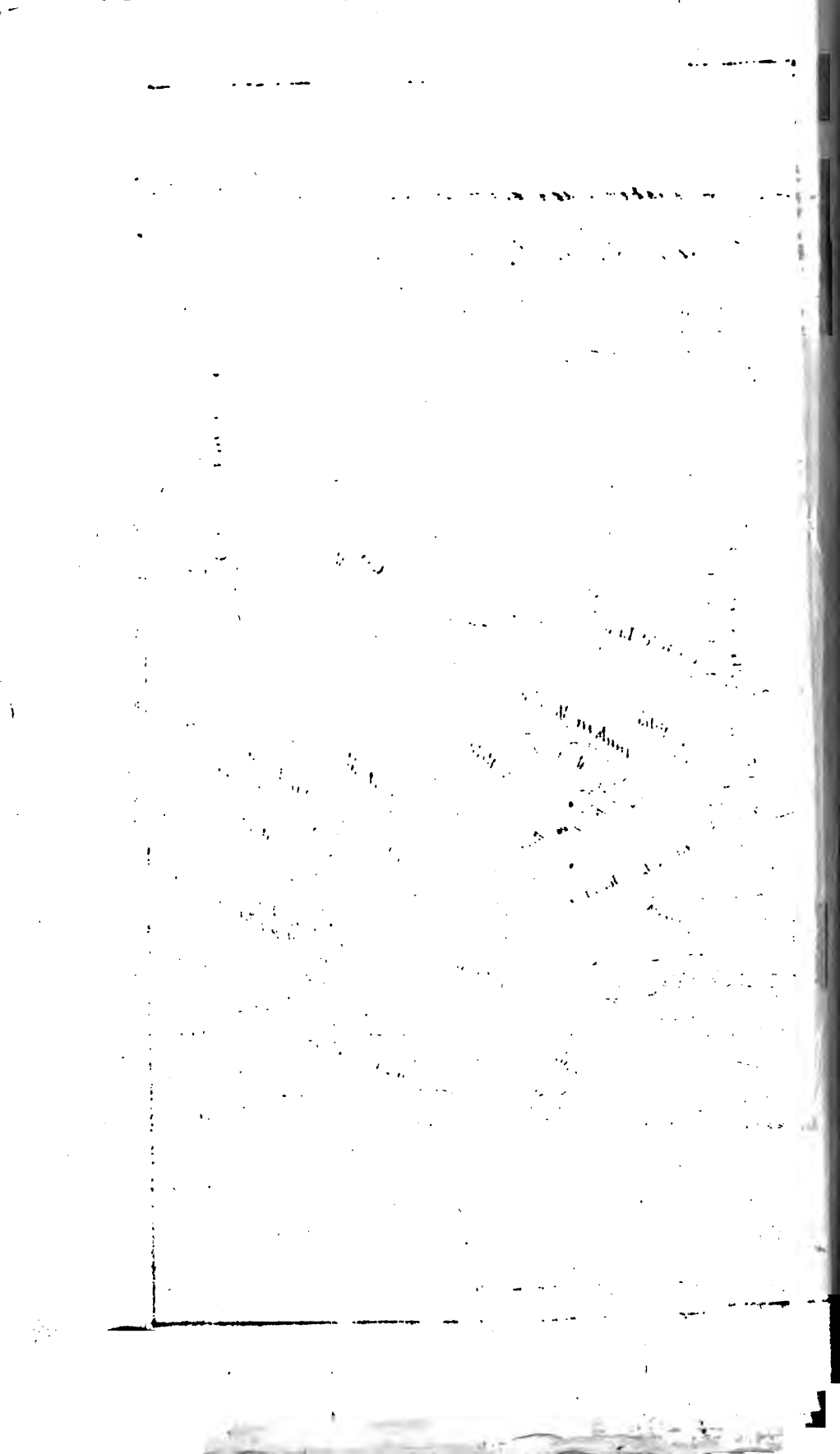
aldwin Eng.r

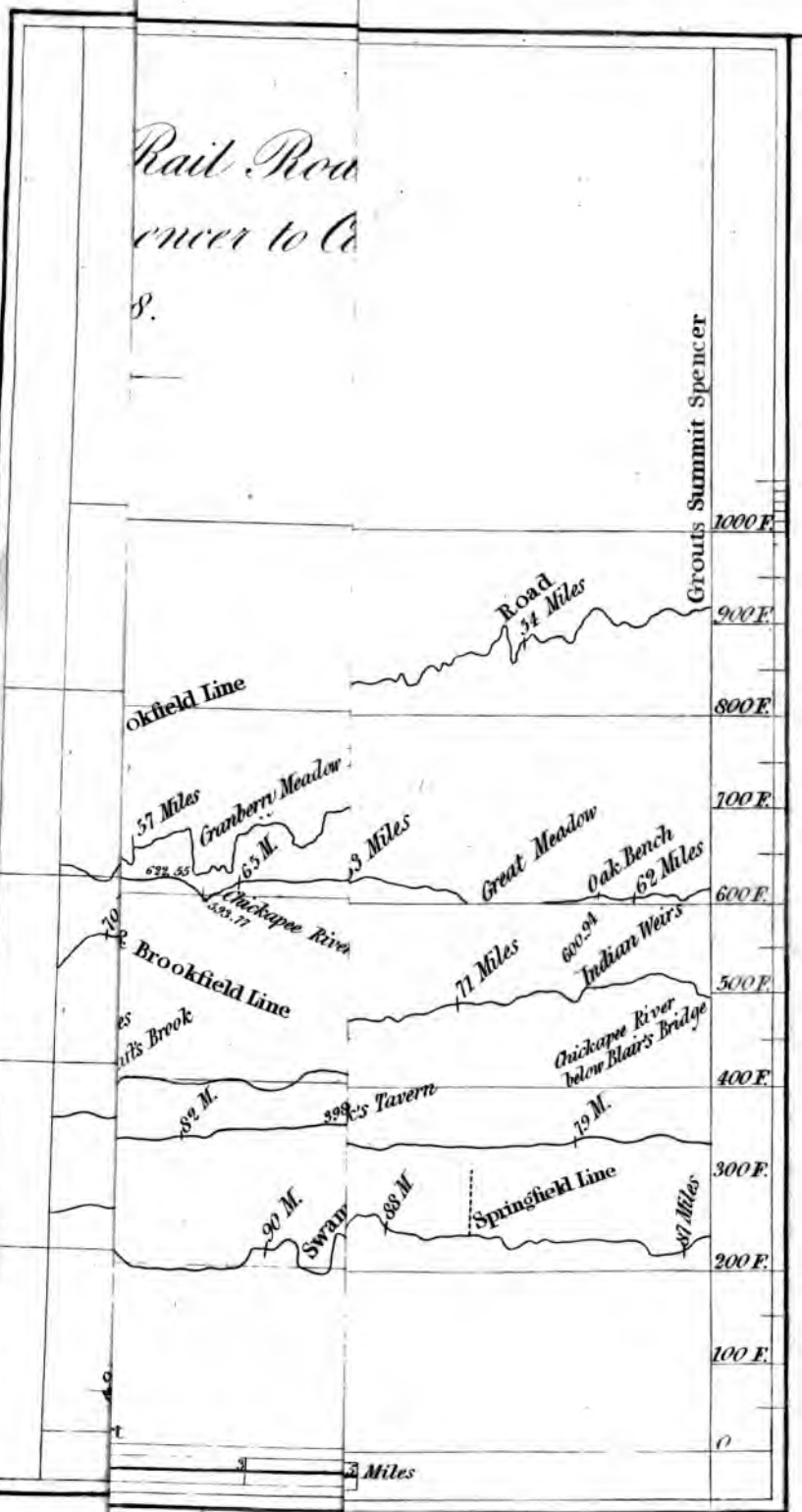
P28

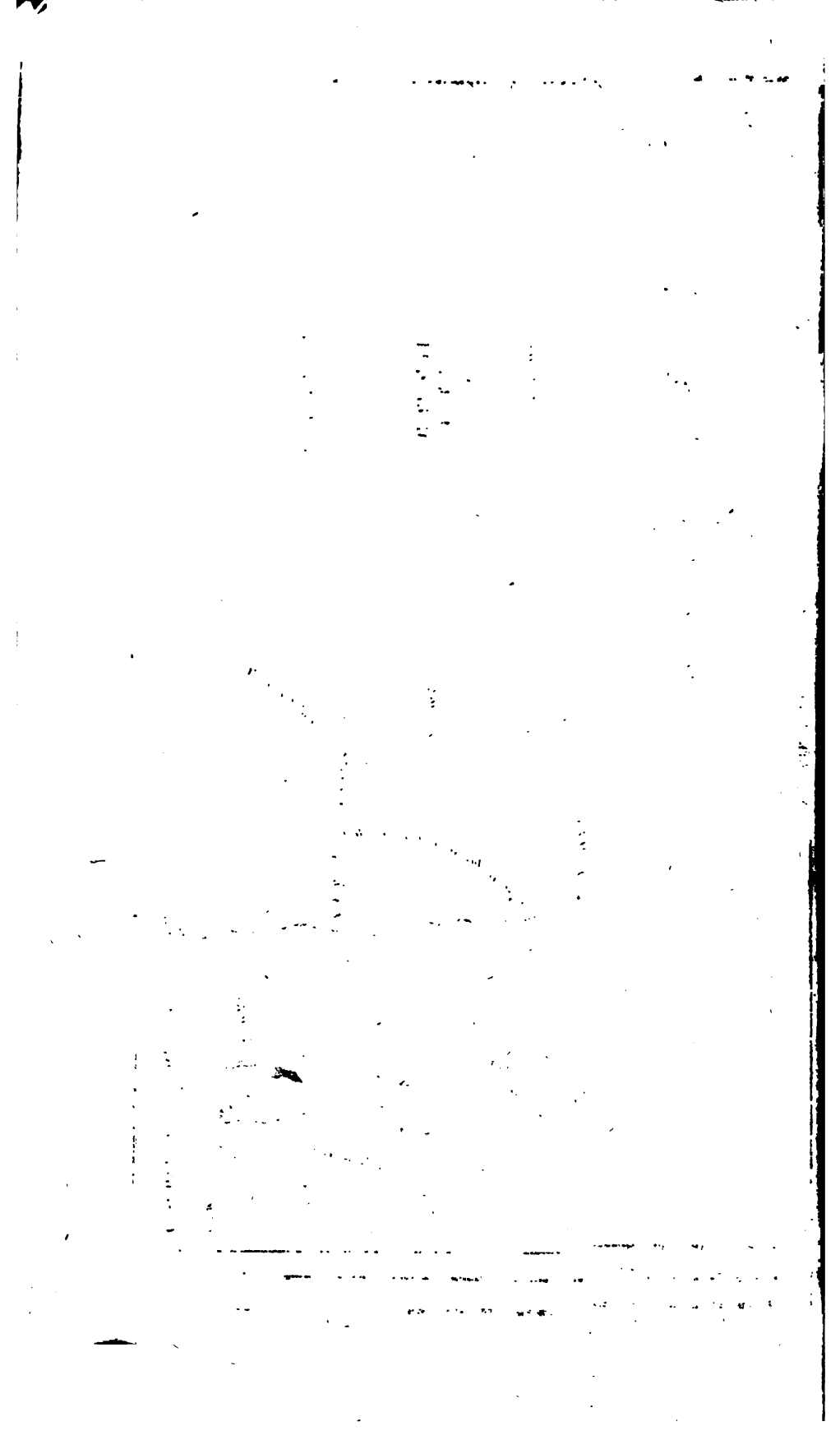
nnecticut River

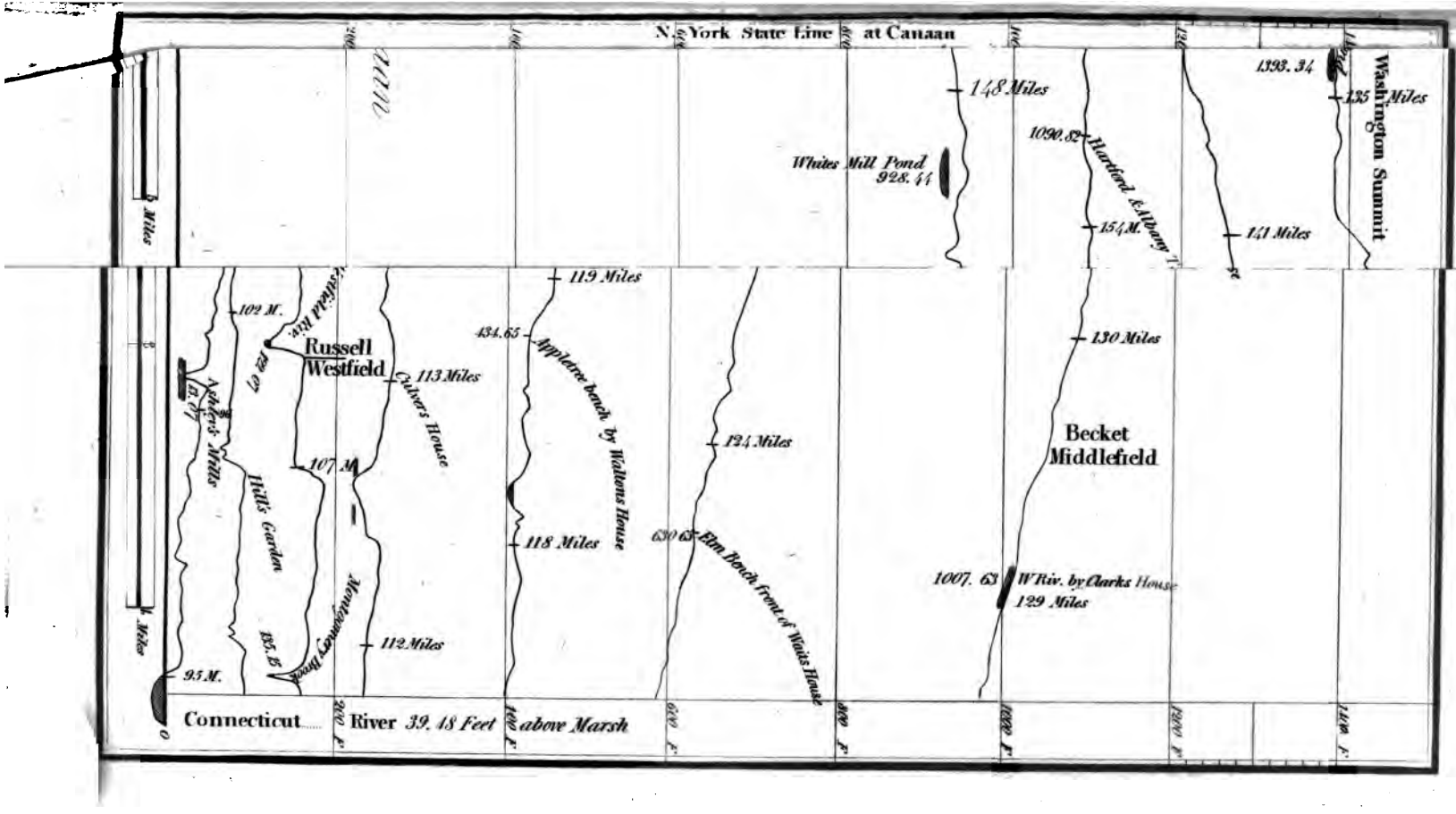


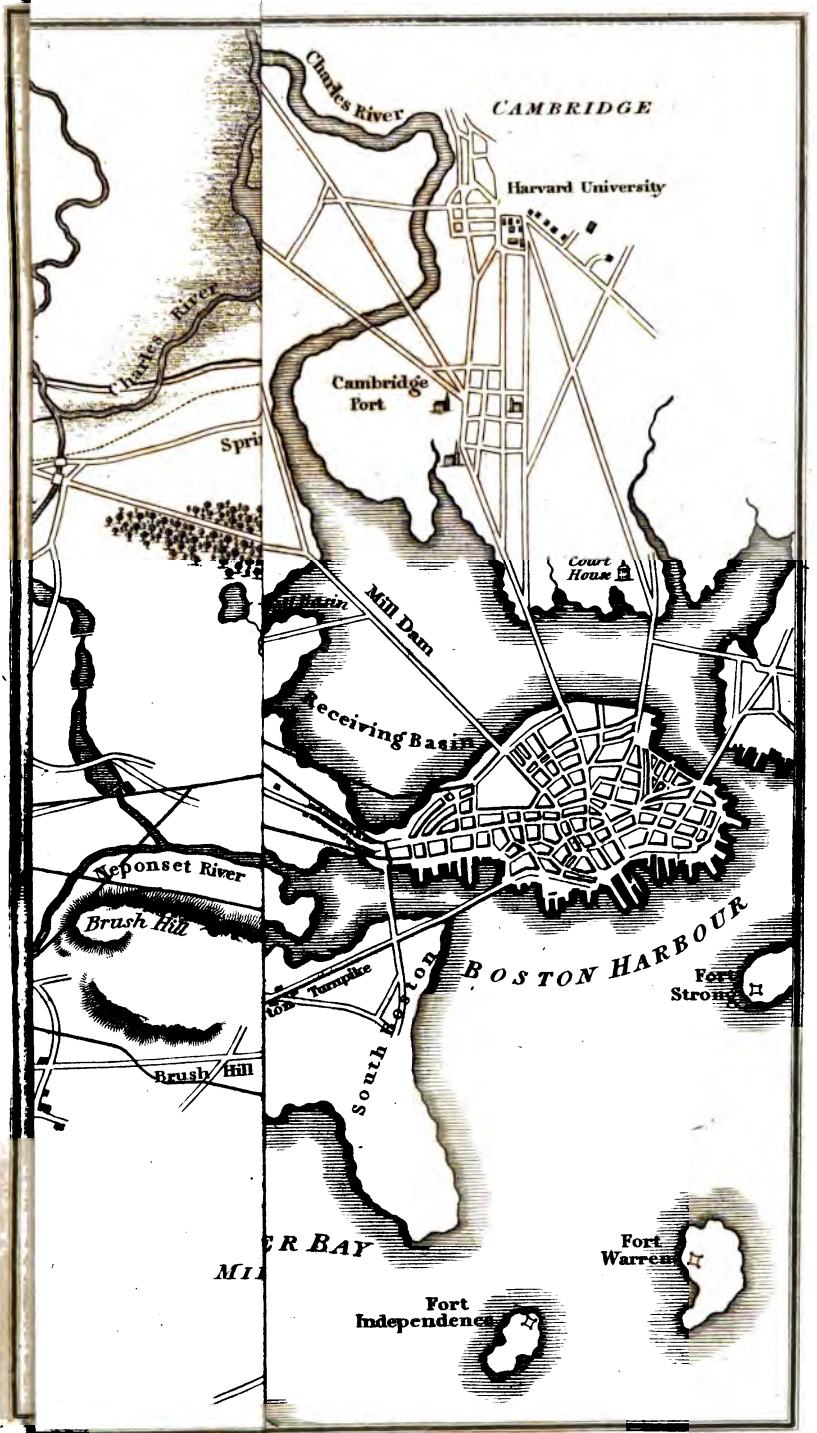

Profile No 1
Of a Survey for a
RAIL-ROAD
to N. York State line at Canaan.
By
James F. Baldwin.
December 1828.
1000 Ft
800 Ft
600 Ft
400 Ft
200 Ft
Base
Charles River
Needham
Charles R.
Newton
Blackstone Canal
Beacon Butternut
Talnick Valley
Charlestown Mead.
Com. Riv.
Shepherds Mill
Elm Bench
Holliston
Framingham
3 Miles
4 Miles
4 3 Miles
33 Miles
22 M.
11 M.
61.
1 M. 139
285.12
305.44
414.26
418.22




Rail Roa
ncer to C
s.
Grouts Summit Spencer
1000 F.
900 F.
800 F.
700 F.
600 F.
500 F.
400 F.
300 F.
200 F.
100 F.
0
Road
34 Miles
okfield Line
37 Miles
Cranberry Meadow
6.5 M.
3 Miles
Great Meadow
Oak Bench
62 Miles
632.55
535.77
Chickapee River
Brookfield Line
77 Miles
600.94
Indian Weirs
Chickapee River
below Blair's Bridge
8.2 M.
3.98
's Tavern
7.9 M.
9.0 M.
Swamp
8.8 M.
Springfield Line
87 Miles
Miles




N. York State Line at Canaan
148 Miles
Whites Mill Pond
928. 44
1090. 82
Hartford & Albany R.
154 M.
141 Miles
1393. 34
135 Miles
Washington Summit
119 Miles
434. 65
Appletree beach by Waltons House
124 Miles
130 Miles
Becket
Middlefield
102 M.
Russell
Westfield
113 Miles
Culvers House
107 M.
Ashers Mills
Hills Garden
Montgomery Brook
112 Miles
118 Miles
630 65
Elm Bench front of Waits House
1007. 63
W Riv. by Clarks House
129 Miles
95 M.
Connecticut River 39. 48 Feet above Marsh


Charles River
CAMBRIDGE
Harvard University
Charles River
Cambridge Port
Court House
Mill Dam
Receiving Basin
Neponset River
Brush Hill
Turnpike
BOSTON HARBOUR
Fort Strong
South Boston
Brush Hill
Fort Warren
Fort Independence

REPORT OF MR. BALDWIN

ON THE

RAIL-ROAD SURVEYS

From Boston to the Hudson River.

TO THE BOARD OF DIRECTORS OF INTERNAL IMPROVEMENTS.

Boston, December 16*th*, 1828.

Gentlemen,

Having been appointed by you in April last, to continue the examination and surveys, for a route for the contemplated Rail Road from Boston to the Hudson River, and having attended to this service, accompanied by Royal Makepeace, Esq. one of the Board, I now respectfully offer a Report, in relation thereto.

It is already known to the Board, that surveys for the same object were made last year of a part of what has been called the Southern route, under the direction of the late Board of Commissioners; to wit, from Boston to Needham, and from Palmer to Connecticut River in Springfield, and from thence to the Hudson River opposite to Albany, as

has been shewn by their Report to the Legislature of 28th January last.

To complete the unfinished portion of this Southern route, was the first object which claimed attention this spring; and accordingly the surveys were commenced in April, at Needham, and carried on to Palmer, thereby completing one entire line from Boston to Albany.

The next route surveyed was a Northern one, from Boston to the Connecticut River, near Northampton. This line passes through Cambridgeport, Watertown, Waltham, Weston, East Sudbury, Sudbury, Marlboro', Berlin, West Boylston, Holden, Princeton, Rutland, Barre, Hardwick, New Braintree, Ware, (Village), Palmer, Belchertown, Granby, to Rock ferry on Connecticut River, in South Hadley. The heights and distances on this line are given in the Table.

After completing the surveys of a Northern route thus far, some time was spent in examining the country westward from Northampton across the high lands to the Hoosic River, with a view of continuing the surveys for a Northern line, if any route should appear favorable, from Rock ferry to that point. We were accompanied by gentlemen from Northampton, and others on the line, who were most familiar with the country.

The route examined is from Rock ferry to Williamsburgh; thence by the north branch of Mill River to Conway; thence along a high range of land through the southerly part of Ashfield and the northerly part of Plainfield, to the height of land in Savoy; thence to the Hoosic in the South Village in Adams.

The greatest obstacle on this line, is the abrupt descent from the summit in Savoy westward, to the

Bridge over the Hoosic River in South Adams, which was found by a survey made by Mr. David Anthony Jr. of Adams, to be 1134 feet in the distance of five miles and fifty eight rods. This makes the Savoy summit 450 feet higher than the Washington summit. This result induced us to discontinue the examination of the route from Northampton *through Savoy,* to Hoosic River. And as all other routes, north of Northampton, especially that by the Deerfield River, would probably unite at the same point on the ridge in Savoy, and the difficulties of a western descent become common to all, no farther examination of the country between this ridge and Connecticut River was made. Gen. Hoyt of Deerfield was employed, however, to furnish such a description of the country from surveys he had heretofore made on the Deerfield River, as would give to the Board some idea of the route in that direction.

From the plan and description of the country, since communicated by Gen. Hoyt, it seems that the course pointed out by him as the most feasible for a Northern route through Deerfield, is to leave the line surveyed for a canal by L. Baldwin, at Gunn's Bridge on Miller's River in Montague, and proceed southerly and westerly five miles to the Connecticut River at Wilson's, about a mile below the mouth of Deerfield River. Thence westerly to Deerfield River, and then by its valley to Stebbins' Mill Dam, distance seven miles, ascent 45 feet. Thence northwesterly by the same River, eight miles nine and a half chains to the head of Shelburn falls, ascent 252 feet. Thence one mile to Town Plain, rise 51 feet. Thence westerly 10 miles 14 chains, to the mouth of Cold River, which comes in from the southwest, ascent 159 feet. Thence by

Cold River to Gulf Stream, 5 miles and 8 chains, rise 579 feet. Thence to the summit by Haskins' Tavern, near the old Glass Works on Hoosic Mountain, 5 miles and 70 chains, ascent 800 feet.

The following table will shew the rate of ascent per mile, provided the inclination can be made uniform throughout each section, which may not be the case.

	Distance. m. ch.	Ascent.	Feet per Mile.	Feet above Con. Riv. at mouth of Deerfield River.
From Conn. Riv. to Stebbins' Dam	7 "	45 Ft	6 " 43	45
Thence to head of Shelburn Falls	8 " 9½	252 "	31 " 04	297
Thence to Town Plain - - -	1 " 00	51 "	51 "	348
Thence to mouth of Cold River -	10 " 14	159 "	15 " 62	507
Thence to Gulf Stream - - - -	5 " 08	579 "	113 " 52	1086
Thence to the summit which is west of, and about 200 feet below the summit which the present road now passes over near Rice's.	5 " 70	800 "	136 " 17	1886
	37 21½	1886		

Whitman's Saw Mill yard, in North Village in Adams, is 663 feet above the Connecticut in Springfield, and allowing the river to be 60 feet higher at the mouth of Deerfield River than at Springfield, Haskins' summit would be 1163 feet above North Village in Adams, and the distance probably three miles.

Gen. Hoyt supposes from information he has received, that there probably may be a better course up the Gulf Stream, leaving the Cold River route at its mouth, and so passing over the mountain further south in Savoy. But by Mr. Anthony's survey, the Savoy summit is 1134 feet above the South Village in Adams, so that the amount of the descent westward to Hoosic River, would be nearly equal to that from Haskins' to the North Village.

It appears from these surveys, that the summit at Haskins, is not so high above the Connecticut River, if the supposed ascent of 60 feet from Springfield be correct, as the Savoy summit, for there is a fall

from the South to the North Village in Adams of 106 feet.

Another route more south from Northampton, through Southampton, Westhampton and Norwich to Norwich Bridge, on the north branch of Westfield River, was next looked over, in hopes of finding ground favorable enough to unite the Northern with the Southern route at Chester Village. But on this line also, we met with too great a descent from the high ground in Norwich to the Westfield River at the Bridge, the fall being 563, 69 feet in 235,26 chains.*

From the knowledge thus obtained of the country west of Northampton, it was not thought expedient to prosecute the surveys for a Northern route any farther, and of course the surveyed line for a Northern route terminates at Rock ferry on Connecticut River.

The next route surveyed was that from Dalton by the Hoosic River, to the line of the State of New York. This was done to compare the advantages of a Northern route from Dalton, leading to Troy on the Hudson River, with that surveyed last year, leading through Pittsfield and Canaan to Albany.

This Northern route will leave the Pittsfield line in Dalton, and crossing the Housatonic River, enter the valley of the Hoosic at Powell's Mills in Lanesborough, thence following the Hoosic valley and passing through Cheshire, Adams, Williamstown and Pownal, in the State of Vermont, intersect the line of New York in Petersburgh, and thence on to Troy. The descent and distance by this line as far as the boundary of New York is stated in the table.

* The Summit in Norwich I have supposed to be from 890 to 900 feet above the Connecticut River at Springfield.

After terminating the survey of the Hoosic River route, a survey was made fromthe State line in West Stockbridge (about 8 chains south of, and 56,13 feet lower than the point where the survey of last fall crossed it) through West Stockbridge Village, Stockbridge, Lee and Lenox to Dalton, and there again united with the Albany line. This line, following in part Williams' River from West Stockbridge Village to Stockbridge, is made circuitous, from the necessity of winding southerly around the south end of Stockbridge mountain. A more direct course would have been by the Turnpike over the hill, but there was a rise to the summit from the village Mill Pond, of 210,63 feet in 150,30 chains, and a descent from the summit to the Housatonic River at Lester's Bridge in Stockbridge of 292,93 feet in 192,14 chains. From Stockbridge to Dalton, the line is up the valley of the Housatonic River, through Lee and Lenox, passing near Wells' Tavern in the easterly part of Pittsfield.

Another route from the Housatonic River in Lee, by the Green Water River and Pond, to the height of land in Becket, and thence to connect with the main line at some point on the Westfield River, was examined and a portion of it surveyed. The survey was commenced on the summit in Becket, south of Mr. Viets', and continued with a descent westward, graduated at the rate of 80 feet per mile where necessary, which was most of the way, passing Thomas' Pond and Mill, till the flat ground was gained north of Chaffee's Tavern in Becket. From thence the country is more level till Green Water Pond is passed, from which the fall of the stream, by which the survey was made, gradually increases until it exceeds 80 feet per mile, and then the line was kept upon the side hill, south of the Green

Water River, passing about 98 feet above the River Road against Wilcox's Tavern in Lee, till it was discontinued at the east edge of a deep and broad valley of a tributary stream, called Goose Pond Brook. The difficulty of passing this valley, appearing rather formidable, and the fall of the Green Water River still increasing, and the high range our line was assuming, created strong doubts of gaining the Housatonic valley by any tolerably direct course, even if other obstacles could be overcome; we therefore concluded to run a trial level from our line on the side hill, by the road to the Turnpike Bridge over the Housatonic River, and thence on to join the main line from Lee to Dalton, at stake No. 172, with a view to ascertain the relation of the side hill line, to the River valley. By doing this, we found our line upon the side hill was 213,16 feet above the Turnpike Bridge, and the distance to it 99,70 chains. From the Bridge to stake No. 172 is 78,02 chains. We also found by joining the surveys, that the Becket summit by Viets', was 239,96 feet higher than the summit in Washington, and 1129,54 feet higher than the Bridge over Walker Brook, by Col. Henry's on the main line, and the distance, by the Walker Brook valley, though not measured from Viets' to Col. Henry's, is probably about 7 miles. These facts, shewing too great a descent for the length of line, prevented our prosecuting the surveys any farther on this route.

From the State line to stake No. 172 on the Housatonic route is 1221,83 chains, thence to the summit by Viets', is 1049,54, making 28,39-100 miles from the State line to Viets', The Bridge over Walker Brook by Col. Henry's on the main line is 2164,88 chains from the west side of Connecticut

River, and 551,08 feet above it. The country from the summit in Otis by the little Westfield River to Westfield was also examined; but portions of it, especially the valley of the River below the Granville Road, were too steep to admit a belief that a line in that direction would be found suited to an uniform descent of 80 feet per mile. And although the height of land in Otis may be lower than that farther north in Becket, still the ascent from the Housatonic in Lee to the Green Water Pond, must in some way be overcome on this, as well as on the Becket route.

On the Southern route between Boston and Springfield, several new lines have been surveyed, connecting with the first, in order to ascertain their comparative advantages.

One of these is from Boston running north of the first line, through Watertown to Needham, and is about half a mile longer than the first.

Another from the Brewery in Worcester, running south of the first line to Jones' Ridge in Worcester, and is 16 chains shorter than the first.

Another is from Wait's Meadow Brook in Leicester, south of the first line, which was through Wait's Meadow, to Livermore's Ridge in Leicester, passing Henshaw's Ridge, and is over a mile shorter than the first.

Another from Grout's summit in Spencer, running north of the first line, which was by Podunk Pond, to near Olds' Bridge in Brookfield, passing the Seven Mile Brook below Gallop's Mill, and the Five Mile Brook at the Furnace in Brookfield, and is 10 chains shorter than the first.

On the Northern Route an attempt was made to cross over from Buffon's Factory on the Quinipoxet, a branch of the Nashua, in Holden, to Clark's

Factory on the Ware river in Barre, to avoid the northern bend through Princeton. The survey was pursued till the summit in Rutland was passed, but was broken off on the western descent, near the neighborhood of New Boston in Rutland, on account of the difficulty of crossing Long Meadow Brook Valley. The summit in Rutland, at the road two miles north east of the meeting house, is 1049. 52 feet above the marsh level, and 80.61 feet above the Princeton summit.

These surveys, with a short one connecting the Northern and Southern routes in Palmer, are all which have been made by me this season, and the first rough drafts of the plans, together with the profiles of them all, are herewith submitted. These with the finished plans and profiles of the surveys made last year, and heretofore presented to the Board, will exhibit all the lines which I have run, since the examination was first commenced.

The examination and surveys, within the state of New York, having been carried on by a Board of Commissioners and an Engineer under the authority of that state, our surveys, this season, have not extended beyond the New York line.

From the preceding remarks, it will appear that the shortest and only connected line from Boston to Dalton, is through Springfield and by the Westfield and Housatonic Rivers. The distance to Connecticut River in Springfield being 94 80-100 miles, and from thence to Dalton 47 72-100 miles.

From Dalton three courses may be taken to the New York state line.

One is by the Housatonic River, through the east part of Pittsfield, Lenox, Lee and Stockbridge, and thence up Williams' River through West

Stockbridge village to New York line in Canaan, a distance of 31 57-100 miles.

Another from Dalton through Pittsfield, Richmond and the north-west corner of West Stockbridge, to the same point in Canaan, a distance of 18 2-100 miles.

The other from Dalton by the Hoosic River through Lanesborough, Cheshire, Adams, Williamstown, and Pownal in Vermont, to the New York line in Petersburgh, a distance of 33 37-100 miles.

In forming an estimate of the cost of building the road, I have calculated, agreeably to the order of the Board, for one route only, and this is the Southern route to Springfield, and thence by the Westfield River to the summit in Washington, thence through Hinsdale, Dalton, Pittsfield, Richmond and West Stockbridge to the New York line.

DESCRIPTION OF THE SOUTH ROUTE,

From Boston to the state line in Canaan, on which the cost of building the road has been estimated.

The line begins at Charles street on the west side of the City of Boston, and is mostly over the Charles river, [which it crosses twice,] and marshes, to Brighton. The road here will be level for nearly three miles, and five feet above the level of the marsh. Bridges of wood will be necessary across the channels of the river, and across the flats, an earth embankment, supported by side walls of stone, and across the marshes, by a foundation on piles and an embankment. Thence to the river again opposite the Arsenal, and along its right bank and the side hill to Mr. Hunnewell's in Newton. Thence crossing the Watertown road near Angier's corner to Newton meeting house. Thence

by College Hill to Charles River again below Newton lower falls, and thence crossing the river to an Elm, No. 130, by a small pond in Needham, half a mile north of White and Sargent's tavern on the Worcester Turnpike. The ridges in the neighborhood of College Hill must be considerably reduced, and a heavy embankment, 32 feet high, raised across Charles river by the lower Falls. A more favorable line I think may be had by keeping more to the south after leaving Mr. Hunnewell's as far as the ridges. And again, by making the high ground towards the Church at the lower Falls, the embankment across the river valley might perhaps be shortened.

From the Elm, the line crosses the turnpike, and then runs near the Needham road, passing north of Needham, West Parish meeting house, and crossing Morse's mill stream to Natick meeting house. Morse's mill stream to be passed by an embankment 38 to 40 feet high, and a summit partly of rock, dividing the waters of Charles and Concord rivers in Natick, to be reduced about 15 feet.

From Natick meeting house to the Old Baptist meeting house in Framingham, on the right bank of Concord river, the line passes by the south end of Long Pond, crosses two inlets into it, and Steep Brook and Beaver Dam Brook, then by Captain Clark's and the south end of Farm Pond. Another line farther north, by Sanger's tavern, is said to be more level.

From the Baptist meeting house the valley of Concord river is followed to Morse's mills in Westborough. The line crosses the river twice near Shepherd's mills, passes west of Bigelow's paper manufactory, and crosses the river three times be-

tween Bigelow's and Whiting's. The most expensive part of this section, will be in crossing the stream.

From Morse's mill to Boardman's barn north of the meeting house in Westborough, the route is north of the great cedar swamp, by Chamberlain's, and passes some broad meadow ground, but the mud is not deep.

From Boardman's barn to Cutler's summit in Grafton, which divides the waters of the Elzebeth and Blackstone rivers, the line crosses the former river by Harrington's mills, and the Charlestown meadow valley, south of Col. Brigham's. The former to be passed by an embankment 14 feet, and the latter, 28 feet high. Cutler's summit to be reduced 10 feet, and a brook valley filled up east of it. Thence to the Indian Weirs, on the outlet of Long Pond in Grafton, half a mile above the New England Factory. This line is over broken and uneven ground, and some portion rocky; the stream to be passed about 10 feet above the water.

From the Indian Weirs the route is over meadows and ridges, and along the foot of the side hill east of Harrington's tavern, passing near Gray's and Stearns', and by the spring, to the side hill east of the brewery in Worcester. Thence by Fox's house, and crossing the canal below the first lock, then a meadow and brook and along sloping land, to the great road by Simon Gates'; thence across the Tatnick brook valley one fourth of a mile north of New Worcester, to the ridge south west of Jones' tavern in Worcester. The embankment across the Tatnick valley will be expensive, being for nine chains about 29 feet high, and for 20 chains, 20 to 25 feet high: as also across several deep hollows between that valley and the ridge.

From the ridge by Jones', the route is by Kettle brook, a branch of the Blackstone, passing Harrington's mill, the dam of which must be removed, to Bottomly's factory, and thence to Henshaw's ridge, which divides the waters of the Blackstone and French rivers, in Leicester. This ridge to be cut through a depth of 36 feet and base 9 chains.

From Henshaw's ridge to Livermore's ridge in Leicester, the line is across some meadows, but should be carried more northerly, by which piling for a foundation may probably be avoided, and better ground, after passing the meadow, be found. Thence to the summit by Grout's, in Spencer, which is the highest point passed over between Boston and Connecticut river, and divides the waters of French and Chickapee rivers. The line passes Saddler's meadow near the junction of Burncoat and Town meadow brook, and east of Jones' tavern, and by Watson's saw mill. The summit is 918.22 feet above the marsh level.

From the Spencer summit to Nathan Bemis', the line is mostly by a side hill and sloping ground, and the descent is at the rate of about 80 feet per mile, passing by Howland's and Luther's, and crossing a hollow 36 feet, and Cranberry meadow Brook valley, 31 feet below the surface of the road.

From Nathan Bemis' the line is over Sleighton's ridge, crosses 7 Mile Brook below Gallop's mill, near Sleighton's carding machine, and 5 Mile Brook by the furnace, and along the plains south of Steven's tavern, to Howard's, near Olds' bridge in Brookfield.

From Old's bridge, the broad meadows of Chickapee river must be passed, and the road have probably a foundation of piles. After passing these meadows north of the river, the ground is favora-

ble to the Chickapee river, in the West Parish in in Brookfield.

From thence the river is to be crossed and the line continued over hollows and ridges, north of Mr. Makepeace's house, to the "City" in Western.

From the "City" to Sedgwick's tavern in Palmer, the line is mostly by the Chickapee river, crossing it at several points and passing east and south of Col. King's, and crossing the Chickapee from the left to the right bank, about a mile below his house. It is thought, however, that an improvement on this line may be made, by crossing the river above Col. King's.

From Sedgwick's the line crosses from the right to the left bank of the Chickapee river, just below the bridge, but should, I think, be crossed higher up, that the high ground soon to be passed, may be more easily approached. The line from Sedgwick's leaves the river and the Three Rivers Factory to the north, and comes on to the river again at the mouth of Twelve Mile Brook in Wilbraham, near where Lyon was murdered. Thence by a steep side hill to the flat country by Glover's. Here the road must be laid for several chains on the north steep end of Wilbraham mountain, which shuts quite down to the river; the present road, which is below the line of the rail road, being now supported by a river wall.

From Glover's to Springfield, the line passes about a mile south of Jenk's factory in Ludlow, and south of Dimick's tavern, crossing several swamps, till it makes the west edge of the plains, near the head of Garden brook, in Springfield.

From the plains, by the Garden Brook valley, the natural descent of the ground is too great for the inclination of the road, and a deep cut in the west

side of the plains must be made, and the valley raised by an embankment. From Garden Brook valley the line crosses the main street in Springfield by the Poor House, and meets the Connecticut river about three-fourths of a mile above Springfield bridge, crossing the intervales or meadows, where the road must be raised by an embankment, leaving water courses for the passage of water in freshes.

The Connecticut river must be passed by a wooden bridge 1122 feet in length, supported upon stone abutments and piers, the necessary height of which, I have supposed to be eight feet above the high water mark as it was in March 1801, commonly called the Jefferson flood. This will make the bridge 24.62 feet above the water as it was when the survey was made, which was said to be five or six feet above low water mark.

From the Connecticut river, westward, through West Springfield, the line is for a mile across the intervale, to the left bank of the Agawam or Westfield river, near Ashley's mill. Thence by the same bank, to Morley's bridge, at the east line of Westfield. Part of this line is along precipitous banks of red sand stone, and across deep ravines and coves of the river, and some walls will be necessary to support the road, and some excavation of rock.

From Morley's bridge through Westfield to Tekoa, the entrance of the mountain country, the line is on the left bank of the river, mostly over intervale and plain ground, requiring embankments in some places, especially at Frog Hole Brook. The Hampshire and Hampden canal is passed on this line by Noble's mills, near the aqueduct. On a portion of this section, say three fourths of a

mile above Montgomery brook, the line must be changed, and the cost of this part has been estimated without a survey.

At Tekoa the river is to be crossed from the left to the right bank, by a wooden bridge 250 feet long and 32 feet above the stream, supported upon abutments and piers of stone. From this point the survey was made upon the right bank, through Russel and Chester village, and then by the west branch of Westfield river, still on the right bank, crossing Walker brook by Col. Henry's, to Capt. Root's in Middlefield. About 1 3-4 miles above Tekoa, the dam for the Hampshire and Hampden canal feeder is built, and the feeder carried along on the left bank of the river. But for this circumstance, a better route for the road would be on that side, and there still may be room enough for it to pass there. Above the feeder dam, the left bank of the river may afford advantages in building the road not found on the right bank; but this cannot be correctly ascertained without a survey. This portion of the river route, 17 1-2 miles in length, is much varied in its surface and character. The building of the road in many places will be expensive, for the steep side hills of rock come quite down to the water's edge, and the shores are indented, so that to preserve a proper direction for the road, points of rock must be blown off, and coves of the river and hollows must be filled up, and walls raised to support the road. Where I thought the nature of the ground would warrant it, and that the expense might be lessened, I have deviated from the surveyed line in making the estimate.

From Capt. Root's to M'Elwain's in Becket, for 5 or 6 miles, the route is through a wild and rugged

country, but still in the valley of the River, with but very little flat margin on either side, and no settlements except Clark's. The side hill, most of the way, must be followed, from 10 to 30 feet higher than the stream. By crossing the River twice, the steepest and most abrupt banks, especially Walnut Hill and the Rackoon Rocks, may be avoided. The survey was along the margin of the stream, and chiefly by the rocky shore; but in fixing the inclination of the road, which is nearly uniform, I find that the line will run on to the side hill, in some places 20 to 30 feet above the water, and of course out of the surveyed track; and for this reason, the cost may not have been so accurately fixed. It may be found on further examination, that the whole line from Root's to McElwain's, may be kept on the left bank of the River, and the inclination made uniform for the whole distance; if so, the ascent will be at a less rate than 80 feet per mile.

From McElwain's to the summit in Washington, is about 3 1-2 miles. The most Northern of the three branches of Westfield River, which unite at McElwain's, was taken, and the valley of this stream was kept, as far as Capt. Crane's in Washington, within a mile of the summit; and here the stream was left to the west, and our course continued on northerly, direct to the summit; for as we could not properly graduate our ascent to the Ridge without knowing its height, we were not particular as to the course we took. It now appears that the survey was over too low ground, and in order to pass the summit with 20 feet cutting, the ascent should be uniform from McElwain's, and the side hill be kept east of the surveyed line and of Capt. Crane's, which I think is high enough for the pur-

pose. The rate of ascent, and the depth of cutting on the summit, have been fixed according to the *measured line*, so that if the side hill route should be of the same length, the inclination and excavation on the summit would not be increased. But the line by the side hill will be, I think, longer perhaps 10 or 15 chains, so that if the cutting on the summit remains the same, the inclination will be less; or if the inclination is unchanged, the cutting will be less. The ridge however should be reduced to favor the descent northward.

The summit Ridge is open pasture land, with but few stones on the surface. It runs nearly northeast and south west, and the road from Washington easterly to Middlefield, passes along it. The survey from the southerly side of the ridge, was through and in the bottom of a narrow ravine, the banks of which are about 20 feet high and of crumbling rocks, which probably might be ploughed up. A spring issues from the ravine and runs southerly into Westfield River. As far as the ravine extends above the plane of the road, one of its banks must be removed for a sufficient breadth to allow for the necessary depth of cutting below its base. This ravine is passed, however, 15 or 20 rods before coming to the summit, which is at an apple tree in Sibley's field, 10 rods north of the road.

This summit is 1440,64 feet above Connecticut River at Springfield, and the highest point of land the road will pass over between Connecticut and Hudson Rivers. It divides the waters of the Housatonic and Westfield Rivers. It is here, a narrow part of the range of high land, extending northeasterly from the Washington mountain to the high range of hills in Peru, and is undoubtedly greatly below either. The line passes round the Wash-

ington range of hills in Dalton, where it turns gradually from a northerly to a westerly direction, following the valley of the Housatonic River.

From the summit northwesterly, for 20 or 30 chains, the descent will be easy to the swamp ground, from which rise the head waters of the Housatonic River. From thence to Merriman's Mills in Hinsdale, nearly five miles, the country is nearly level. The surveyed line was by Mud Pond, and its outlet, and meadow land most of the way. This line may in some measure be improved as to ground and distance.

From Merriman's Mills, the descent of 80 feet per mile must commence, and the line continued by the left bank of Housatonic River and the side hill, to the Housatonic River in Pittsfield. The descent might commence earlier by removing Merriman's Mill Dam, thereby to lessen the inclination, or else to bring the road on to lower ground in Dalton, which would favor the passage of the River on the Hoosic Route. Another advantage would be gained by removing the Dam, which is the draining of the flat country above, and making the road more secure over the meadows.

By the line surveyed last year from Merriman's Mills to Dalton, a bend of the River to the northeast was cut off by passing through a hollow, back from the River and west of the road, near the line of Hinsdale and Dalton; but at the highest part of this hollow, the cutting would be 50 or 60 feet, to preserve an uniform descent of 80 feet per mile from Merriman's to the River in Pittsfield. To avoid this deep cut, although increasing the distance, the survey for the Hoosic or Troy route, was commenced south of this hollow, at stake No. 72, and carried round by the river, where no obsta-

cle of this sort was found. By this amended line, I think the road would be located for the Pittsfield route, in preference to the other, as far as No. 36, in Dalton, from which point the several routes diverge.

From No. 36, the Pittsfield route descends along the side hill to the Housatonic, near Levi Goodrich's. The road on this line will be located nearer the River and lower upon the side hill, than the survey last year was carried. The change made on this section to avoid the hollow, as above mentioned, may affect the estimated cost of forming the road.

After getting down to the Housatonic, it must be crossed at Goodrich's, and the line kept on the right bank by Gen. Willis', Gen. Root's Factory, White's Mills, and Hollister's, to the Pontoosack, or west branch of the Housatonic River in Pittsfield, below the Factory.

Thence westerly to the west bank of Shakers' Mill Brook, and thence partly by its valley and partly by a side hill to the Shakers' Mill in Pittsfield; this portion has some broken, rough and rocky ground, and is ascending.

From the Mill, the line is near and up the stream, crossing it twice, and passing some swampy ground, and undulating hard land, to Rev. Mr. Dwight's in Richmond. The swell of land, passed over soon after leaving the Mill, will be too high; a better course would be easterly by Stearns' old Mill, where more favorable land may be had.

From the height of land near Mr. Dwight's, the side hill westward of the surveyed line must be followed for about two miles, as far as Leadbetter's, keeping to the southeast of Capt. Gates', in order that the descent may be made more gradual, than it would be over the ground where the line was

run. By changing the line to gain the side hill, the termination of the preceding section, would be west of Mr. Dwights. All these alterations render the estimate of expense less certain.

From Leadbetter's, the line is by a Brook and Col. Rowley's, to Hackley's; thence by Griffin's, Arnold's, and Hewin's, to the State line in Canaan, and is over broken and some rocky ground. An alteration might perhaps be made, by passing south of Col. Rowley's, and crossing the Brook half a mile below his house, and then joining the surveyed line again below Hackley's.

Here terminates one route from Boston to the line of the State of New York, and the distance by it is 160 54-100 miles. Thence to Greenbush Ferry on the Hudson River opposite Albany, by the survey of last year, is 37 52-100 miles, making the whole distance 198 6-100 miles.

It should have been remarked, that in fixing the point of departure from Boston, no particular object was in view, other than to obtain a good direction to the point in Brighton, which it seemed necessary to make, in going westward. This end of the line was the first surveyed last year, and although some conversation was had with members of the City Government, relative to the termination of the road on the Boston shore of Charles River, and such encouragement was held out, as to a landing place, on the grounds belonging to the City, as would, at a proper time, be worthy of consideration, still it was not thought necessary fully to discuss this important question, before the preliminary surveys were made. Many considerations will have weight in fixing definitively the location of the Rail Road at its Eastern extremity; and whether it ultimately comes in over or by the side of the

Boston and Roxbury Mill Dam, or over or by the side of the West Boston Bridge and the causeway connected with it; no other advantage can arise by so doing, other than a saving of expense in forming the road, and leading it to a commodious Depot; for the line on either of these routes cannot be made shorter than that surveyed. Whatever course is taken, the facilities of travelling on the road at its eastern termination, would be about equal; for nearly a level plane for 2 or 3 miles from Boston, may be had on either line. If new works to cross Charles River and the marshes, unconnected with those now built, are to be erected, the cost must be taken at the estimate; for the road cannot probably be carried to Brighton at a less expense, in the same distance, in any other course.

CONSTRUCTION OF THE ROAD.

The following is the manner proposed for building the Road, which is in conformity to the views of the Board.

The Road is to have two tracks, or Carriage Ways, and to be formed 22 feet in width; that is, the excavation to be 22 feet in width at the surface of the road, with the banks sloping 18 inches horizontal, to each foot in height, except in rock, where it will be only 20 feet in width, and the sides nearly perpendicular. The embankments to be 22 feet broad on the top, and sloped as above.

The Bridges over the largest streams to be of wood, supported on Abutments and Piers of stone, and 20 feet interior breadth. And for the smaller streams, culverts of stone are to be built and covered with the embankments. The surface of the

road to be made straight and conformable to the inclination of the Plane.

When the road is thus formed, four parallel trenches are to be made longitudinally in it, two feet deep, and two feet wide, in which, trench walls of 2½ feet height are to be laid, to support the Rail Stone. The earth thrown from the trenches will cover the trench walls, and about half the depth of the Rail Stones.

The Rail Stone to be from 5 to 10 feet in length, and about one foot square, and firmly set upon the trench walls, in parallel lines five feet apart, leaving a space of 5 feet between the tracks. About 3 inches of the upper surface of the Rail Stone to be finely hammered, to receive the flat plate or bar of iron. The interior edge of the Rail Stone, 1½ inch in depth from the upper hammered surface, to be hewed a little battering, for the flange of the wheel to pass along it. The upper surface of the stone which is not hewed, to be beaten off, so as to slope downward from the iron plate. The ends of the stone to be hammered so as to make a close butt joint when brought together. Six inches of the bed of the stones at each end, to be made straight, parallel to, and equidistant from the upper surface, to give a more firm bearing at the ends, which will rest upon the same stone in the trench wall. The Rail Stone to have coarse gravel or broken stone placed against them, to keep them more firm on their beds.

The horse paths, or space between the rails of each track, to be covered with gravel six or eight inches thick.

Upon the Rail Stone when set, the flat plates or bars of rolled iron, 2 inches wide and 3-8 inch thick, are to be fixed by iron pins, 3-8 inch

diameter, and 3 inches in length, driven when heated, through holes in the bars, into holes in the stones.

The sidelings or passing places, leading from one track to the other, to be of similar construction as the main rails, about 100 feet in length, and 8 of them in a mile, which will give four for each track.

Gutters or water courses, to be made on one or both sides of the road where necessary, and surface drains occasionally across it.

Explanation of the following Table.

This Table shews the height, distance, inclination, &c. of the Rail Road from Boston to New York State line in Canaan; embracing as many portions of the road as there are planes, whether horizontal or inclined.

In the first column, are contained the names of the towns, and principal places, passed on the line.

The second column shews the number of the station or stake, at which the plane terminates. The numbers however are not all in the regular series of the first survey, several other surveys having been made afterwards, and some of them adopted, to improve the first line.

The third, shews the distance from Boston, of the Western termination of each plane, in miles, chains, and links.

The fourth, the length of each plane or section, in chains and links.

The fifth, the ascent in each plane, in feet and hundredths.

The sixth, the descent in each plane, in feet and hundredths.

The seventh, the rate of inclination of each plane per mile, in feet and hundredths.

The eighth, shews the surface of the *road* when formed, without regard to the height of the present surface of the ground, at the end of each plane, above the marsh level, taken at the first stake after crossing Charles River, on Whittemore's marsh, in Cambridge Port.

The ninth column contains the number of cubic yards of excavation and embankment in each section or plane.

The tenth, the estimated cost of Excavation and Embankment in each plane, in dollars and cents.

The eleventh, the estimated cost of Bridges, Culverts, Piling and Wall, in each section or plane.

The last column shews the amount of the estimated cost of Excavation, and Embankment, Bridges, &c. in each plane, in dollars and cents.

Boston, Cambridge, Watertown, Newton, Needham, Natick, Framingham, Westboro'.

Towns and Places Passed.	No of Sta.	Distance from Boston	Length of Plane	Ascent in each Plane.	Descent in each Plane.	Inclination per Mile.	Height above Marsh.	Cub. Yds. of Excav. and Emb.	Cost of Excavation and Embankments.	Cost of Bridges Culverts, Piling and Wall.	AMOUNT.
The line begins 5 ft. above marsh l.		M. Ch. L.	Ch. Lk's.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.		Dolls. Cts.	Dolls. Cts.	Dollars. Cents.
From Charles st. Boston		29.83	29.83	.	.	Level	5.	. .	. . .	29,389 50	29,389 50
to Cambridge	1	1 9.50	59.67	.	.	Level	5.	. .	51,552 00	. . .	51,552 00
Crossing Charles River	14	2 65.15	135.65	.	.	Level	5.	33,975	3,397 50	19,090 60	22,488 10
Brighton	24	3 72.28	87.13	24.50	.	22.49	29.50	15,628	1,310 00	17 00	1,327 00
	31	4 30.36	38.08	.	15.20	31.93	14.30	23,929	1,895 64	150 00	2,045 64
Newton - -	42	5 55.90	105.54	10.33	.	7.83	24.63	42,684	2,709 84	35 00	2,744 84
Passing Old Brewery	47	6 20.85	44.95	22.95	.	40.84	47.58	4,484	374 16	70 00	444 16
Watertown -	53	6 62.60	41.75	.	11.08	21.33	36.50	23,903	1,713 99	75 00	1,788 99
Newton - - -	60	7 25.14	42.54	8.90	.	16.73	45.40	11,799	921 71	25 00	946 71
	65	7 53.70	28.56	.	10.43	29.22	34.97	15,355	1,273 81	30 00	1,303 81
	67	7 72.86	19.16	8.08	.	33.74	43.05	2,794	192 71	. . .	192 71
	70	8 8.20	15.34	.	6.75	35.20	36.30	2,548	178 33	20 00	198 33
Passing Bigelow's Tav.	73	8 31.66	23.46	10.61	.	36.18	46.91	5,485	403 61	. . .	403 61
	78	8 76.67	45.01	11.22	.	19.94	58.13	14,861	1,915 45	20 00	1,935 45
	87	9 34.26	37.59	36.47	.	77.61	94.60	29,791	2,681 12	. . .	2,681 12
	97	9 62.46	28.20	.	26.20	74.32	68.40	27,891	1,811 93	. . .	1,811 93
	109	10 26.26	43,80	.	18.26	33.35	50.14	25,114	2,213 20	50 00	2,263 20
	112	10 49.49	23.23	.	.	Level	50.14	1,334	66 71	. . .	66 71
Crossing Charles River, Needham Lower Falls - -	130	11 59.16	89.67	89.47	.	79.82	139.61	88,687	9,876 66	2,440 00	12,316 66
	136	12 21.95	42.79	4.39	.	8.21	144.00	7,271	581 68	10 0	591 68
	141	12 56.85	34.90	.	12.94	29.66	131.06	8,924	892 40	. . .	892 40

	152	13 44.39	67.54	.	.	Level	131.06	30,222	3,324	42	55	00	3,379 42
	155	13 67.17	22.78	4.34	.	15.24	135.40	8,213	780	23	.	. .	780 23
	161	14 31.06	43.89	13.12	.	23.91	148.52	23,513	2,586	43	.	. .	2,586 43
	167	14 50.50	19.44	.	.	Level	148.52	14,139	1,696	68	.	. .	1,696 68
Natick, passing Morse's Saw mill	179	15 46.57	76.07	43.46	.	45.71	191.98	65,301	10,318	92	310	00	10,628 92
Long Pond -		17 22.12	135.55	.	56.48	33.33	135.50	60,121	5,156	60	100	00	5,256 60
	214	18 57.00	114.88	20.12	.	14.01	155.62	47,249	5,137	63	200	00	5,337 63
Framingham - -	227	20 09.35	112.35	.	.	Level	155.62	43,433	4,827	87	50	00	4,877 87
Pass. S. of Farm Pond, Bap. M. H.	238	21 12.48	83.13	25.48	.	24.52	181.10	28,034	3,342	51	80	00	3,422 51
Crossing Concord River, Hollis-ton, Shepherd's Mill -	251	22 37.57	105.09	.	6.34	4.82	174.76	45,851	6,873	14	278	00	7,151 14
Hopkinton, Crossing Concord Riv.	263	24 02.12	124.55	28.29	.	18.17	203.05	27,952	2,371	98	320	00	2,691 98
Framingham -	273	25 12.58	90.46	16.03	.	14.17	219.08	21,661	2,672	60	100	00	2,772 60
Southborough, crossing Concord R	278	25 42.85	30.27	10.51	.	27.77	229.59	20,431	2,782	60	500	00	3,282 60
Crossing Concord Riv.	284	26 9. 5	46.20	4.45	.	7.70	234.04	10,742	1,166	64	550	00	1,716 64
	287	26 32.41	23.36	17.25	.	59.07	251.29	7,116	1.013	72	40	00	1,053 72
	306	28 26. 3	153.62	29.39	.	15.30	280.68	37,236	4,511	62	175	00	4,686 62
Westborough -	312	29 14. 9	68.06	8.06	.	9.47	288.74	18,462	2,078	29	30	00	2,108 29
	321	29 76.26	62.17	.	3.68	4.74	285.06	24,100	2,642	21	48	00	2,690 21
	325	30 27.81	31.55	.	6.11	15.49	278.95	8,636	863	60	20	00	883 60
Boardman's Barn	330	30 69.26	41.45	2.48	.	4·78	281.43	9,610	961	00	40	00	1,001 00
	340	31 65.45	76.19	22.69	.	23.79	304.12	18,718	2,025	85	65	00	2,090 85
Pass. Harrington's Mill.	344	32 11.53	26.08	.	6.84	20.98	297.28	13,434	1,438	96	133	00	1,571 96
	349	32 52.41	40.88	24.06	.	47.08	331,34	6,432	643	29	.	. .	643 29
	354	33 5.46	33. 5	.	10.10	24.45	311,24	10,652	1,262	26	27	00	1,289 26
	357	33 29.03	23.57	1.01	.	3.43	312,25	6,451	774	22	.	. .	774 22
Charlestown Meadows, Grafton	380	35 23.37	154.34	88.32	.	45.78	400,57	88,062	12,646	97	270	00	12,916 97
Summit by Cutler's	385	35 55.69	32.32	.55	.	1.36	401,12	21,518	2,638	23	46	00	2,684 23

Grafton—Millbury—Worcester—Liecester—Spencer—Brookfield—Western.

Towns and Places Passed.	No. of Sta.	Distance from Boston.	Length of Plane.	Ascent in each Plane.	Descent in each Plane.	Inclination per Mile.	Height above Marsh.	Cub Yds. of Excav. and Emb	Cos of Excavation and Embankments.	Cost of bridges Culverts, Piling and Wall.	AMOUNT.
		M. Ch. L.	Ch. L.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.		Dolls. Cts.	Dolls. Cts.	Dolls. Cts.
	395	36 46.91	71.22	.	42.81	48.08	358.31	29,283	3,875 93	84 50	3,960 43
	406	37 11.26	44.35	20.35	.	36.71	378.66	32,015	3,999 56	95 50	4,095 06
Passing Indian Weirs	414	37 55.10	43.84	.	18.75	34.22	359.91	21,278	2.717 07	101 50	2,818 57
	420	38 25.12	20.02	18.41	.	29.44	378.32	2,255	2,576 20	44 50	2,620 70
Millbury, Worcester L.		38 64.96	39.84	26.64	.	53.49	404.96	9,815	1,191 99	. . .	1,191 99
	430	39 04.87	19.91	.	9.52	38.25	395.44	11,315	1,444 84	. . .	1,444 84
	451	40 9.81	84.94	83.65	.	78.78	479.09	76,420	9,873 03	143 00	10,016 03
	462	40 69.50	59.69	33.41	.	44.77	512.50	11,866	1,416 08	29 00	1,445 08
	468	41 19.28	29.78	.	.	Level	512.50	24'407	2,291 34	36 50	2,327 84
	473	41 54.78	35.50	25.01	.	56.47	537.51	14,071	1,768 81	. . .	1,768 81
Pass. Blackstone Canal	54	42 61.27	86.49	.	84.01	77.69	453.50	50,312	6,277 39	220 00	6,497 39
	46	43 31.16	49.89	12.50	.	20.05	466.00	25,945	2,569 16	192 50	2,761 66
	41	43 75.61	44.45	32.50	.	58.49	498.50	14'480	1,185 17	70 50	1,255 67
Crossing great Road from Worcester to Northampton	36	44 19.19	23.58	.	.	Level	498.50	19,078	1,907 88	230 00	2,137 88
Henshaw's Ridge, Liecester, Passing Tatnick Valley.	5	48 0.28	301.09	299.50	.	79.57	798.00	297,991	39,319 35	765 75	40,085 10
	9	48 19.62	19.34	.	.	Level	798.00	11,834	922 51	33 75	956 26
	16	48 49.79	30.17	16.46	.	43.64	814.46	26,474	3,078 07	. . .	3,078 07
	23	49 17.25	47.46	4.04	.	6.81	818.50	21,716	2,364 66	71 50	2,436 16
Livermore's Ridge	28	49 51.13	33.88	16.50	.	38.96	835.	14,442	1,469 17	14 00	1,483 17
Saddler's Meadow	591	50 1.29	30.16	.	9.00	23.87	826.00	38,620	13,036 01	253 50	13,289 51
	602	50 74.38	73.09	34.00	.	37.21	860.00	67,561	7,908 53	198 00	8,106 53

Spencer - -	612	51 58.05	63.67	.	14.75	18.53	845.25	44,380	5,123	64	38	00	5,161	64
Watson - -	618	52 24.80	46.75	28.03	.	47.96	873.28	21,539	2,539	51	.	. .	2,539	51
Grout's Summit -	629	53 25.53	80.73	41.26	.	40.89	914.54	30,584	3,409	37	80	50	3,489	87
	631	53 38.58	13.05	.	13.05	80.00	901.49	3,788	682	78	.	. .	682	78
	18	54 41.15	82.57	.	79.36	76.89	822.13	35,946	10,260	21	121	50	10,381	71
Passing Cranberry Meadow Brook	55	56 67.62	186.47	.	185.83	79.72	636.30	156,869	16,578	59	443	25	17,021	84
	62	57 39.97	52.35	3.31	.	5.06	639.61	15,234	1,574	28	23	00	1,597	28
Brookfield, Gallop's mill	67	57 70.65	30.68	.	12.11	31.57	627.50	20,450	2,077	08	87	50	2,164	58
Furnace - -	84	58 57.50	66.85	.	11.20	13.40	616.30	48,268	4,759	05	758	25	5,517	30
	87	59 24.30	46.80	10.79	.	18.44	627.09	13,462	958	91	.	. .	958	91
	95	60 9.16	64.86	.	22.04	27.18	605.05	5,410	413	21	.	. .	413	21
	99	60 29.86	20.70	.	2.05	7.92	603.00	2,530	328	89	.	. .	328	89
Crossing Moore's brook	103	60 68.97	39.11	6.30	.	12.88	609.30	6,769	747	61	86	50	834	11
	105	61 18.34	29.37	.	9.30	25.33	600.00	4,944	518	34	.	. .	518	34
Cranberry Hill -	107	61 30.21	11.87	5.00	.	33.69	605.00	3,573	412	84	25	50	438	34
	734	61 40.05	9.84	.	6.75	54.88	598.25	3,357	223	21	834	00	1,057	21
	736	61 53.56	13.51	7.25	.	42.93	605.50	3,974	256	95	.	. .	256	95
	742	62 23.51	49.95	.	8.50	13.61	597.00	7,198	704	45	62	00	766	45
Cross Great Meadows	748	62 71.73	48.22	15.00	.	24.88	612.00	16,924	1,628	17	2,074	00	3,702	17
	751	63 14.81	23.08	.	8.78	30.43	603.22	2,821	141	04	.	. .	141	04
	755	63 48.32	33.51	8.20	.	19.58	611.42	5,431	605	81	18	50	624	31
	761	64 15.26	46.94	.	9.42	16.05	602.00	9,278	650	35	111	50	761	85
	764	64 54.95	39.69	4.36	.	8.80	606.36	4,307	152	43	15	00	167	43
	767	65 0.71	25.76	.	4.09	12.70	602.27	5,541	515	08	.	. .	515	08
Cross Chickapee Riv.	770	65 25.52	24.81	8.98	.	28.95	611.25	6,760	482	46	1,758	00	2,240	46
	773	65 56.27	30.75	.	9.05	23.54	602.20	6,037	632	84	.	. .	632	84
Western - -	776	66 4.81	28.54	.	1.26	3.53	600.94	9,194	600	17	11	00	611	17

Western—Brimfield—Palmer—Monson—Wilbraham—Spring field—West-Spring field.

Towns and Places Passed.	No. of Sta.	Distance from Boston.	Length of Plane.	Ascent in each Plane.	Descent in each Plane.	Inclination per Mile.	Height above Marsh.	Cub. Yds. of Excav. and Emb.	Cost of Excavation and Embankments.	Cost of bridges Culverts, Piling and Wall	AMOUNT.
		M. Ch. L.	Ch. L.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.		Dolls. Cts.	Dolls. Cts.	Dolls. Cts.
	780	66 26.73	21.92	2.56	.	9.34	603.50	7,050	661 16	46 25	707 41
	789	66 76. 4	49.31	.	7.00	11.35	596.50	21,920	1,502 56	24 50	1,527 06
	791	67 20.31	24.27	15.00	.	49.44	611.50	5,657	339 42	. . .	339 42
Pass. Patten's Factory	798	67 63.30	42.99	.	19.27	35.86	592.23	20,206	1,654 53	447 75	2,102 28
Crossing Chickapee River, Passing Partrick's Bridge.	810	69 17.18	113.88	.	41.79	29.35	550.44	25,424	3,067 00	1,794 00	4,861 00
	815	69 57.05	39.87	.	18.44	37.00	532.00	7,111	847 72	51 00	898 72
Crossing Chickapee R.	821	70 14.76	37.71	.	20.47	43.48	511.53	18,066	1,701 00	2,229 50	3,930 50
	826	70 44.65	29.89	.	8,95	23.95	502.58	14,776	1,388 88	54 75	1,443 63
Passing Blair & Hodges	846	72 23.25	138.60	.	90.54	52.26	412.04	57,918	6,051 63	574 50	6,626 13
Brimfield - -	870	75 04.39	221.14	.	37.04	13.39	375.00	62.855	5,647 82	220 00	5,867 82
	874	75 39.33	34.94	.	12.00	27.47	363.00	4,270	298 90	. . .	298 90
Crossing Chickapee	879	75 79.86	40.53	1.00	.	1.97	364.00	14,112	1,172 51	1,374 00	2,546 51
River, Palmer.	882	76 33.49	33.63	7.01	.	16.67	371.01	8,707	747 82	21 50	769 32
	887	77 10.37	56.88	.	29.47	41.45	341.54	5,650	577 87	85 00	662 87
Passing Blanchard's	890	77 42.21	31.84	9.41	.	23.64	350.95	11,999	1,178 61	. . .	1,178 61
Mill.	893	77 75.22	33.01	.	6.71	16.20	344.24	5,047	429 58	26 00	455 58
	900	78 61.69	66,47	.	2.36	2.84	341.88	8,685	694 80	18 50	713 30
	902	79 10.05	28.36	.	9.33	26.32	332.55	3,051	264 50	. . .	264 50
	905	79 50.36	40.31	.	.38	.75	332.17	3,584	179 20	. . .	179 20
Passing Sedgwick's	911	80 7. 2	36,66	.	16.17	35,28	316.00	8,200	730 02	. . .	730 02
Monson, Crossing Chickapee river	9	80 57.34	50.32	50.32	.	80,00	366.32	43,974	5,304 86	2,909 00	8,213 86

	20	81 52.31	74.97	.	24.47	26.11	341.85	13,008	1,558 56	11 00	1,569 56
	25	82 13.08	40.77	.	12.52	24.56	329.33	7,761	807 59	17 00	824 59
Wilbraham -	36	83 08.17	75.09	.	55.50	59.13	273.83	13,148	1,341 24	. . .	1,341 24
	49	83 58.12	49.95	.	42.35	67.82	231.48	43,776	3,261 06	133 00	3,394 06
	59	84 26.47	48.35	16.00	.	26.47	247.48	14,625	1,262 28	3,069 50	4,331 78
	74	85 18.80	72.33	4.05	.	4.48	251.53	47,005	4,308 14	. . .	4,308 14
	94	87 04.55	145.75	.	23.65	12.98	227.88	63,571	5,392 20	96 25	5,488 45
Springfield -	104	87 72.68	68.13	13.60	.	15.96	241.48	11,173	1,223 93	. . .	1,223 93
	115	88 60.20	67.52	.	20.60	24.41	220.88	20,286	1,502 10	. . .	1,502 10
	119	89 26.62	46.42	.	1.93	3.33	218.95	8,473	1,042 37	122 50	1,164 87
	136	90 16.85	70.23	.	18.70	21.30	200.25	48,327	3,772 92	. . .	3,772 92
	145	90 60.97	44.12	12.25	.	22.21	212.50	15,472	1,314 48	. . .	1,314 48
	155	91 40.89	59.92	.	6.76	9.02	205.74	10,716	1,217 82	. . .	1,217 82
	161	91 65.49	24.60	19.85	.	64.55	225.59	12,812	896 84	. . .	896 84
	181	93 20.12	114.63	.	113.69	79.34	111.90	107,419	11,716 15	642 00	12,358 15
	185	93 55.33	35.21	.	28.33	64.36	83.57	5,540	664 80	. . .	664 80
	190	94 12.97	37.64	.	17.08	36.30	66.49	22,267	1,528 55	27 50	1,556 05
	196	94 51.92	38.95	.	8.16	16.76	58.33	24,594	1,980 10	1,832 75	3,812 85
Connecticut River	197	94 64.26	12.34	5.77	.	37.40	64.10	12,772	2,043 52	. . .	2,043 52
				1509.80	1445.70		*Height above Conn. R*		421,945 98	79,818 85	501,764 83
The line begins 24.62 above Connecticut River.											
Across Conn. Riv. to	1	95 1.26	17.00	.	.	Level	24.62	. .	. . .	27,000 00	27,000 00
West Springfield	3	95 16.76	15.50	.	6.22	32.10	18.40	7,046	915 98	. . .	915 98
	6	95 37.86	21.10	1.26	.	4.77	19.66	4,860	627 82	95 00	722 82
Ashley's Mills	13	96 2.86	45.00	14.37	.	25.55	34.03	11,859	1,007 85	664 50	1,672 35
	17	96 46.39	43.53	26.27	.	48.28	60.30	11,682	1,585 48	3,344 50	4,929 98

Towns and Places Passed.	No. of Sta.	Distance from Boston. M. Ch. L.	Length of Planes. Ch. L.	Ascent in each Plane. Ft. 1-100.	Descent in each Plane. Ft. 1-100.	Inclination per Mile. Ft. 1-100.	Height above Ct. river Ft. 1-100.	Cub. Yds. of Excav. and Emb.	Cost of Excavation and Embankments. Dolls. Cts.	Cost of bridges Culverts, Piling, and Wall Dolls. Cts.	AMOUNT. Dolls Cts.
	26	97 0.21	33.82	3.61	.	8.54	63.91	9,301	1,428 41	971 00	2,399 41
	38	98 1.09	80.88	41.94	.	41.48	105.85	23,075	2,216 63	959 25	3,175 88
	41	98 28.22	27.13	.	15.41	45.44	90.44	4,827	482 70	99 00	581 70
Taylors - -	48	99 16.22	68.	5.57	.	6.55	96.01	5,135	256 75	18 50	275 25
	53	99 48.04	31.82	.	17.29	43.47	78.72	8,348	810 23	37 50	847 73
	56	99 63.33	15.29	.	.	Level	78.72	12,479	1,306 38	35 00	1,341 38
	60	100 10.16	26.83	7.28	.	21.71	86 00	7,414	697 14	. . .	697 14
Westfield -	72	101 15.53	85.37	.	1.70	1.59	84.30	35,898	2,998 51	379 00	3,377 51
	79	101 74.66	59.13	.	4.39	5.94	79.91	25,966	3,082 55	137 50	3,220 05
	91	103 25.52	110.86	14.68	.	10.59	94.59	14,842	1,228 92	24 50	1,253 42
Hampshire & Hampden Canal.	94	103 45.89	20.37	18.41	.	72.30	113.00	10,987	1,538 18	200 00	1,738 18
	100	103 71.75	25.86	.	17.77	54.97	95.23	12,738	1,145 72	21 00	1,166 72
Dr Sumner's intervale	103	104 21.58	29.83	7.47	.	20.04	102.70	1,713	85 65	17 00	102 65
Passing Calvin Coburn's House.	109	104 76.32	54.74	30.72	.	44.90	133.42	8,614	861 40	55 50	916 90
	113	105 28.77	32.45	.	2.82	6.95	130.60	13,228	997 92	. . .	997 92
	117	105 56.27	27.50	20.40	.	59.34	151.00	7,442	446 52	29 00	475 52
School House -	119	106 3.11	26.84	6.00	.	17.88	157.00	1,542	61 68	. . .	61 68
	122	106 22.85	19.74	.	6.34	25.69	150.66	11,183	936 00	180 25	1,116 25
Line Changed -	133	107 4.26	61.41	1.94	.	2.52	152.60	. .	1,700 00	. . .	1,700 00
Mt. Tekoa, Russel, Cross. Westfield R.	148	107 70.70	66.44	5.13	.	6.17	157.73	16,456	1,449 72	4,929 50	6,379 22
	152	108 16.69	25.99	16.37	.	50.39	174.10	8,035	1,017 56	780 50	1,798 06

Salmon Falls . . .	160	108 56.91	40.22	17.31	.	34.43	191.41	21,080	5,017 99	748 00	5,765 99
Dickinson's Intervale	165	109 4.20	27.29	.	4.81	14.10	186.60	5,379	593 02	231 00	824 02
Passing Feeder Dam	169	109 42.33	38.13	16.77	.	35.18	203.37	4,660	279 60	. . .	279 60
	175	109 71.63	29.30	.	4.20	11.46	199.17	10,592	1,279 70	25 00	1,304 70
	177	110 11.28	19.65	8.37	.	34.07	207.54	2,402	192 16	. . .	192 16
	183	110 40.50	29.22	2.26	.	6.18	209.80	13,608	2,306 77	780 50	3,087 27
Doolittle's Tavern	185	110 58.92	18.42	.	.	Level	209.80	1,058	42 32	. . .	42 32
	188	110 77.39	18.47	6.20	.	26.85	216.00	8,758	1,907 16	983 00	2,890 16
	192	111 17.84	20.45	13.53	.	52.92	229.53	7,632	1,097 58	1,207 00	2,304 58
Passing Blair's House	197	111 41.88	24.04	5.60	.	18.63	235.13	7,229	683 04	625 75	1,308 79
Passing Hawley's land	205	111 75.35	33.47	1.44	.	3.44	236.57	12,203	2,458 94	15 00	2,473 94
	209	112 14.65	19.30	11.25	.	46.63	247.82	2,359	165 13	. . .	165 13
	218	112 43.31	28.66	.	2.85	7.96	244.97	10,284	1,234 08	2,145 00	3,379 08
	223	112 77.03	33.72	22.10	.	52.43	267.07	7,992	911 98	921 50	1,833 48
Passing Culver's house	227	113 30.45	33.42	.	.	Level	267.07	4,745	863 71	130 50	994 21
Gould's House . .	235	113 73.97	43.52	35.13	.	64.58	302.20	29,997	2,240 76	1,169 50	3,410 26
	238	114 17.14	23.17	12.69	.	43.81	314.89	5,513	416 46	. . .	416 46
Blanford	244	114 59.68	42.54	.	10.38	19,52	304.51	8,628	925 52	425 00	1,350 52
	248	115 18.84	39.16	16.55	.	33.70	321.06	4,786	287 16	. . .	287 16
Chester Village .	254	115 58.83	39.99	7.94	.	15.88	329.00	6,904	783 40	286 50	1,069 90
Blanford . .	258	116 9.60	30.77	19.60	,	50.96	348.60	2,738	195 32	326 00	521 32
	265	116 52.82	43.22	19.10	.	35.35	367.70	8,181	907 03	635 00	1,542 03
Chester . .	269	116 75.25	22.43	1.56	.	5.56	369.26	4,385	307 43	20 00	327 43
	272	117 20.89	25.64	23.58	.	73.57	392.84	2,637	215 69	. . .	215 69
	278	117 66.00	45.11	25.91	.	45.95	418.75	7,293	493 14	39 50	532 64
	283	118 26.59	40.59	4.25	.	8.37	423.00	7,532	572 76	241 50	814 26
	287	118 46.82	20.23	8.50	.	33.61	431.50	5,162	619 44	234 00	853 44

Chester, Middlefield, Washington, Hinsdale, Dalton, Pittsfield, Richmond to Canaan, (N.Y.)

Towns & Places Passed.	No. of Sta.	Distance from Boston.	Length of Planes.	Ascent in each Plane.	Descent in each Plane.	Inclination per Mile.	Height above Ct. river	Cub. Yds. of Excav. and Emb	Cost of Excavation and Embankments.	Cost of bridges Culverts, Piling, and Wall	AMOUNT.
		M. Ch. L.	Ch. L.	Ft. 1-100.	Ft. 1-100.	Ft. 1-100.	Ft 1-100.		Dolls. Cts.	Dolls. Cts.	Dolls Cts.
Pass. Walton's house	290	118 72.34	25.52	8.33	.	26.11	439.83	4,958	594 96	17 00	611 96
	293	119 13.36	21.02	17.03	.	64.81	456.86	1,869	224 28	. . .	224 28
	299	119 50.96	37.60	4.74	.	10.09	461.60	13,028	1,525 91	. . .	1,525 91
	303	119 79.00	28.04	13.48	.	38.46	475.08	9,669	1,326 06	125 00	1,451 06
	315	120 68. 2	69. 2	27.06	.	31.36	502.14	22,113	2,465 32	2,556 00	5,021 32
Glass House .	322	121 51.79	63.77	24.63	.	30.90	526.77	16,745	1,423 82	60 00	1,483 82
	327	122 3.99	32.20	24.94	.	61.96	551.71	5,067	506 70	. . .	506 70
Col. Henry's Tavern	330	122 26.55	22.56	5.05	.	17.90	556.76	5,902	590 20	318 42	908 62
	336	122 74.25	47.70	28.37	.	47.58	585.13	9,382	881 04	20 00	901 04
Passing Fay's Mill	340	123 26.58	32.33	22.17	.	54.85	607.30	7,474	2,009 90	60 00	2,069 90
Pass. Wait's House	347	123 78.89	52.31	41.39	.	63.30	648.69	6,393	767 16	37 00	804 16
	357	124 60.96	62.07	56.21	.	72.44	704.90	13,106	1,368 04	538 50	1,906 54
Passing Root's, Middlefield, Crossing Westfield River.	371	125 61.32	80.36	39.93	.	39.75	744.83	38,879	4,325 10	2,116 30	6,441 40
McElwain's, Becket, crossing Westfield River twice.	439	130 77.04	415.72	415.55	.	79.96	1160.38	101,758	9,721 10	4,986 77	14,707 87
Washington Summit, Line changed.	487	134 28.54	271.50	260.26	.	76.69	1420.64	99,037	15,024 40	250	15,274 40
	7	134 56.14	27.60	.	19.99	57.94	1400.65	29,954	3,906 66	. . .	3,906 66
Hinsdale .	58	139 34.46	378.32	.	13.65	2.90	1387.00	99,037	13,610 52	610 75	14,221 27
Pass. Merriman's M.	72	140 2466	70.20	.	70.20	80.00	1316.80	28,367	2,454 62	395 00	2,849 62
Dalton . .	36	142 42.23	177.57	.	177.57	80.00	1139.23	65,729	5,997 36	66 50	6,063 86
Pittsfield L. changed	125	144 65.15	182.92	.	142.49	62.31	996.74	. .	4,548 64	202 50	4,751 14
Line changed .	132	145 35.33	50.18	.	49.74	79.30	947.00	. .	4,283 99	150 00	4,433 99

Pass. Root's Fac.	151	147 47.87	172.54	.	6.70	2.99	940.30	38,107	3,994,58	618 75	4,613 33
White's Mills	154	147 67.47	19.60	5.86	.	23.92	946.16	3,410	383 18	. . .	383 18
	163	148 58. 9	70.62	.	14.61	16.55	931.55	13,109	1,132 08	17 00	1,149 08
	166	149 9.54	31.45	.	.	Level	931.55	6,451	716 46	615 00	1,331 46
	177	150 5.75	76.21	27.30	.	28.66	958.85	16,944	1,830 25	98 75	1,929 00
	183	150 38.60	32.85	9.10	.	22.16	967.95	13,590	1,667 57	. . .	1,667 57
	192	151 3.85	45.25	30.58	.	54.06	998.53	10,774	1,212 86	26	1,238 86
	197	151 28. 9	24.24	6.42	.	21.19	1004.95	9,831	1,145 52	17 00	1,162 52
Stearns' Factory	205	151 77.81	49.72	45.10	.	72.56	1050.05	17,926	2,388 60	340 25	2,728 85
Pass. Shakers' mill	209	152 28.19	30.38	18.14	.	47.76	1068.19	6,100	734 84	. . .	734 84
Line Changed	216	152 68.91	40.72	.	.	Level	1068.19	. .	897 12	. . .	897 12
Richmond	226	153 64.48	75.57	16.81	.	17.79	1085.00	25,511	3,379 99	812 25	4,192 24
	229	154 15.26	30.78	10.00	.	25.99	1095.00	2,792	186 84	. . .	186 84
	233	154 52.00	36.74	.	8.56	18.64	1086.44	4,050	463 02	16 50	479 52
	237	155 7.23	35.23	16.56	. .	37.60	1103.00	7,215	828 16	21 50	849 66
Parson Dwight	242	155 48.43	41.20	.	.	Level	1103.00	18,519	2,256 70	. . .	2,256 70
Line changed	264	157 17.79	129.36	.	96.13	59.45	1006.87	. .	4,249 20	175 00	4,424 20
	271	157 63.45	45.66	.	19.12	33.50	987.75	10,211	1,208 14	32 50	1,240 64
	284	158 18.17	34.72	.	27.25	62.78	960.50	18,460	2,272 64	239 75	2,512 39
Passing Hackley's	290	158 54.38	36.21	.	10.32	22.80	950.18	7,092	953 21	35 00	988 21
	297	159 1.58	27.20	. .	23.68	69.64	926.50	23,596	3,377 50	. . .	3,377 50
	301	159 35.71	34.13	.	12.11	28.40	914.39	14,560	1,963 19	117 50	2,080 69
West Stockbridge	305	159 58.34	22.63	18.61	.	65.79	933.00	7,618	999 67	. . .	999 67
N. York line at Canaan.		160 44.13	65.79	.	8.00	9.72	925.00	30,372	5,841 37	98 50	5,939 87
From Conn. River to Canaan .				1694.68	794.30				599,467 44	146,777 09	746,244 53
From Boston to Conn. River .				1504.80	1445.70						
				3199.48	2240.00=5439.48 Total Asc. and Desc. from Boston to N. York line.						

Summary of the various inclinations of the Road, with their length in Chains and Links.

Rate of Inclination in Feet per Mile.	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 75	75 to 80	Chains L.	M. Ch. L.
Dist. asc. Westward	1010.69	1152.48	917.36	732.82	916.17	359.16	196.28	157.80	1250.83	6,693 59	83 53.59
do. desc. do.	1251.88	979.37	899.95	530.96	224.76	406.35	330.00	28.20	781.16	5,432 63	67 72.63
	2262.57	2131.85	1817.31	1263.78	1140.93	765.51	526.28	186.00	2031.99	12,126 22	151 46.22
do. Level . . .	. .	. .	. .	. .	. .	. .	. .	. .	. .	717 91	8 77.91
										12,844 13	160 44.13
No. of asc. Planes	22	19	21	19	18	11	6	4	7	127	
No. of desc. Planes	15	16	21	13	5	6	5	1	8	90	
	37	35	42	32	23	17	11	5	15	217	
Level	. .	. .	. .	. .	. .	. .	. .	. .	. .	17	
										234	Whole No. of Planes.

Amount of cost per foregoing Table - - - - - - - -				$ 746,244 53
Side Gutters and additional Culverts . - - - - - - -				4,500 00
Grubbing - - - - - - - - - - - - - -				7,000 00
Extra Stone-work, removing earth, &c. in crossing Roads - - -				3,560 00
Railing for all perpendicular bank Walls and for Embankments over 10 feet high . .		. . .		4,536 00
				$ 765,840 53

IRON, &c.

The following estimate of the Cost of Iron per ton, is from data furnished by the Board, viz. "Estimate of cost of Iron bars prepared for laying, cost in Liverpool on board - - - - - - - - - £9 10s. 0d. Sterling.

Commissions 2 1-2 per cent. 4. 09

	£9 14. 09	= 43 27			
" Premium on Exchange 10 per ct. - - - - - - - -		4 33			
" Duty on £9 14. 9. at 25 per ct. ad. val. - - - - - -		11 90			
" Freight to Boston" and New York - - - - - - - -		3 50			
" Insurance 1 per ct. to cover 48 08 - - - - - - - -		48			
" Wharfage at Boston - - - - - - - - - - - -		30			
		$ 63 78			
Transporting the Iron to the Rail Road - - -		6 22			
		$ 70 00			

The average weight of 4 bars, gives Tons. cwt. qr. lbs. 26 1. 2. 13. for one mile of road, including the passing places, which at $70 per ton, is - - - - - . . $1,825 65

2277 lbs. 3-8 round iron for Pins at 7 cts. per lb. delivered - - -	. .	159 39	
	per mile	$1,985 04	
Considering the localities, quality and quantity of the stone as represented by Mr Willard, in his report to the Board upon this subject, I have estimated the stone work as follows.			
Opening Quarries and making Roads, quarrying the stone, haling, hewing, setting, drilling and putting on Iron 26 1-2 cts. per foot lineal, and amounting per mile of road, including the passing places (22,720 feet) to - -	. .	6,020 80	
Digging Trenches per rod of Road 64 cts, and equal per mile to - -		204 80	
Trench walls do. do. 5,50 cts, and equal per mile to - -		1,760 00	
Gravelling horse paths do. do. 62 1-2 cts, and equal per mile to -	. .	200 00	
	per mile	$10,170 64	
Which for 160 miles, 44 chains, 13 links, amounts to - - - -	. .	. . .	1,632,912 78
Equal to $14,940 70 per mile - - - -			2,398,753 31
Superintendence and Contingencies, 10 per cent. - - - - -			239,875 33
Equal to 16,434 77 per mile - - - -	. .	. . .	2,638,628 64
Lands, Fences and Stone in the Quarry, uncertain			

HOOSIC RIVER ROUTE.

This line leaves the side hill south of Dalton Meetinghouse, at stake No. 36, and crosses the Housatonic River by the old Forge. The road will pass 69 feet above the surface of the water, and about 11 feet above the immediate banks, which are 8 chains distant from each other. Thence in 11 chains, crosses a brook valley 8 1-2 chains broad and 27 feet below the surface of the road.

From the Brook valley, the line is north of the main road, and has a westerly direction (crossing a brook valley 7 chains broad, and 33 feet below the line of the road) till it turns northerly round a point of the hill, half a mile north of Nelson's tavern in Pittsfield. Thence along the side hill and east of Partridge's swamp, to Powell's Mill pond in Lanesborough. Thence by the valley of the Hoosic river or Muddy brook, crossing it to the left bank half a mile below Powell's mill, and continuing on to Comans' mill, where the line crosses to the right or east bank. Thence by Whipple's in Cheshire, to the road near Mason's. Thence, crossing the stream to the west bank, by side hill and ridges, and over some fine land, to the Bridge by Widow Brown, passing south east of Wolcott's Tavern and Cheshire Meetinghouse. Thence by meadow and stream, crossing it twice, to Jenk's Factory, in the north part of Cheshire.

From Jenk's Factory, the line is on the west side of the stream, to Anthony's Factory, in Adams. Thence over ridges and by side hill, to the south village in Adams, cutting off a bend of the river to the south east. Thence by David Anthony's Factory. Thence on west side of the river, and east of the

road, to the Phoenix Factory, in the North Village in Adams. Thence to Jones' Bridge, where the line crosses the river and keeps the right bank through Williamstown, passing near Noble's Bridge and Selcy's Bridge, and west of Stone's Tavern and the Mineral Springs, by Barrett's, to the line of Vermont, near Ware's Tavern. Thence to Lovett's in Pownal in Vermont, the survey was by the road mostly, and the right bank of the river. But probably a better line would be on the west side, crossing the river below Barrett's and again against Lovett's. From Lovett's, the line continues on the right bank of the river, east of Sherman's mill, and by Daniel Evans', Brown's mill and Peter Deal, to the boundary stone, at the line between Vermont and New York, by Pownal Bridge, near Abraham Vosburgh's. The distance from stake No. 36 in Dalton 33 37-100 miles, and from Boston 175 89-100 miles.

THE FOLLOWING TABLE

Shews the Distances, rate of Inclination, &c. on the above described route.

Dalton, Pittsfield, Lanesboro', Cheshire, Adams.

Towns and Places Passed	No. of Sta.	Distance from Boston.	Length of Planes.	Ascent in each Plane.	Desc. in each Plane.	Inclin. per Mile.	Height above Ct. River.
		M. Ch. L.	Ch. L.	ft. 1-100	ft. 1-100	ft. 1-100	
From stake 36, Dalton		142 42.23	.	.	.	.	1139.23
	45	143 7.08	44·85	.	44.85	80.00	1094.38
Pass. Walker's House	51	143 54.38	47.30	25.62	.	43.33	1120.00
Pittsfield .	22	144 38.70	64.32	.	64.32	80.00	1055.68
Cross. brook & valley	25	144 62.25	23.55	.	.	Level	1055.68
Lanesborough	43	146 18.87	116.62	.	79.68	54.66	976.00
Near Powell's Mill	48	146 47.53	28.66	.	.	Level	976.00
	56	146 78.59	31.06	.	24.00	61.82	952.00
	63	147 34.06	35.47	2.40	.	5.41	954.40
Cheshire Line	75	148 36.58	82.52	.	16.40	15.90	938.00
Whipple's House	77	148 62.64	26.06	8.00	.	2.46	946.00
	90	150 6.88	104.24	.	22.55	17.31	923.45
	95	150 63.66	56.78	7.55	.	10.64	931.00
	102	151 32.72	49.06	.	.	Level	931.00
Cheshire Village	104	151 61.97	29.25	7.76	.	21.23	738.76
River and Bridge	109	152 21.89	39.92	.	23.76	47.61	915.00
Pass. Glass House R.	113	152 60.90	39.01	.	.	Level	915.00
	117	153 21.39	40.49	.	12.00	23.71	903.00
Near Jenks' Factory	131	154 79.06	137.67	.	8.00	4.65	895.00
Adams	136	155 44.64	45.58	.	41.00	71.96	854.00
Pass. Jenks' lower F.	139	156 08.54	43.90	.	28.58	52.08	825.42
Pass. Anthony's Fac.	144	156 35.06	26.52	.	6.42	19.37	819.00
South Adams village	156	157 12.91	57.85	.	57.85	80.00	761.15
Pass. Anthony's Fac-	164	158 11.06	78.15	.	49.76	50.93	711.39
P. Browning's House	170	159 10.09	79.03	.	26.39	26.71	685.00
Passing Town House	175	159 68.66	58.57	.	12.00	16.39	673.00
	179	160 37.15	48.49	.	.	Level	673.00
By Jenks' Barn	183	160 76.16	39.01	.	7.49	15.36	665.51
Road . .	186	161 28.13	31.97	6.49	.	16.24	672.00
	191	161 70.39	42.26	.	11.84	22.41	660.16
Whitman's Mills	197	162 59.59	69.20	.	.	Level	660.16
Pass. Adams N. Vill.	203	163 19.10	39.51	.	25.16	50.94	635.00
	207	163 58.46	39.36	.	14.00	28.45	621.00
Cross. Hoosic River	214	164 47.16	68.70	.	18.58	21.63	602.42
Near Blackington's	219	165 28.17	61.01	.	24.44	32.04	577.98
Williamstown	222	165 57.80	29.63	4.02	.	10.85	582.00
Pass. Elisha Hopkins	226	166 27.94	50.14	.	20.05	31.99	561.95
	231	167 9.35	61.41	.	7.95	10 36	554.00
Pass. Williamstown V.	241	168 22.41	93.06	2.00	.	1.72	556.00
Pass. Simond's Bridge	246	168 49.21	26.80	17.04	.	50.86	573.04
" Stone's Tavern	253	169 30.19	60.98	.	40.04	52.53	533.00

Williamstown, Pownal to N.Y. & Vt. Line.

Towns and Places Passed	No of Sta.	Distance from Boston	Length of Planes.	Ascent in each Plane	Desc. in each Plane	Inclin. per Mile.	Height above Ct. River.
Pownal Vermont	259	170 1.72	51.53	·	13.00	20.18	520.00
Pass. Manchester's H.	265	170 52.18	50.46	·	3.00	4.75	517.00
Pass. Levett's House	270	171 42.22	70.04	·	16.00	18.27	501.00
" Wright's Inn	273	171 64.29	22 07	7.00	.	25.37	508.00
" Sherman's Mill	277	172 39.11	54.82	.	20.00	29.19	488.00
Ridge by Bates'	281	172 64.05	24.94	8.00	.	25.66	496 00
Pass. Bates' house	285	173 11.30	27.25	.	16.00	46.97	480.00
High Cliffs	290	173 61.74	50.44	.	6.73	10.67	473.27
Pass. Brown's Mills	295	174 41.05	59.31	.	.	Level	473.27
Against Whipple's T.	297	174 69.62	28.57	.	13.27	37.16	460.00
Peter Deal's House	300	175 26.92	37.30	.	.	Level	460.00
Monument Stone at N.Y. and Vt. Line.	304	175 71.81	44.89	.	4.00	7.13	456.00
		Ascent . .		95.88	779.11		
		Descent .		779.11			
		Total Ascents and Descents . .		874.99	From Stake No. 36 Dalton, to N.Y. & Vt. Line.		

Summary of the various inclinations on the Hoosic Route, with their length in chains & links.

Rates of Inclination in Feet	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	Ch. Links	M. Ch. L.
Planes ascending Westward	154.59	118.38	76.26		47.30	26.80			423.33=	5 23.33
do. descending do.	233.02	492.75	376.19	139.72	67.17	339.16	31.06	212.60=	1891.67=	23 51.33
	387.61	611.13	452.45	139-72	114-47	365.96	31.06	212.60=	2315.00	
Level	.	.	.	.	.	.	.	. .	354.58=	4 34.58
Total distance from Dalton to Vermont and New York Line.	.	.	.	.	.	.	.	. .	2669.58=	33 29.58
Number of ascending Planes	3	3	3		1	1			11	
do. descending do.	3	8	7	3	2	5	1	4	33	
	6	11	10	3	3	6	1	4	44	
Level	.	.	.	.	.	.	.	. .	8	

Whole number of Planes from Dalton to Vermont and New York Line 52

HOUSATONIC ROUTE.

From the main line at No. 36, in Dalton, the road by the Housatonic valley, through Stockbridge, will follow nearly the same line (and of course changed from the surveyed line) as the Pittsfield route, for about two miles, keeping west of Deacon N. Chamberlain's. Thence east of Smith's house, which stands by the Dalton line, and crossing the Washington road one fourth of a mile east of Welles' Tavern, in Pittsfield. Thence to Sackett's Brook, and crossing it about 100 rods above Barnard's mill, keeping a South Westerly course to the road. Thence by and near the road, and East of the Housatonic River, passing West of Howland's and between Sears' and Dewey's to the River, about half a mile below Sears' house. Thence crossing to the West side of the River, and along flat ground, to Lenox Furnace. Thence by the West or right bank of the River, passing several Factories and Paper Mills, to Dr. Hyde's, in Lee, about one fourth of a mile West of the Meeting house. Thence over flat and swampy ground, to stake No. 172, North side of the turnpike. Thence across a swell of land North West of Col. Hills', keeping South of turnpike, to the River, 150 rods above Tremain's Tavern. Thence across the River, and by its South or left bank to the River again, below the road South of Tremain's Tavern. Thence crossing the River, and by its right bank through South Lee village and Owen's paper mills, to he main street in Stockbridge. Thence crossing the street to its North side, near Mr. Williams' store, and keeping North of the South Meeting

house, to the side hill by Lester's store, passing the River twice in one fourth of a mile.

Thence by the left bank of the River, passing Lester's and Seley's Factories, to the south point of Stockbridge mountain. Thence the course is nearly North, and leaving the Housatonic valley, and over descending ground to Williams' River. Thence up the valley of this River, and by its East or left bank, passing the marble quarries and mills, to a brook which comes in from the East. Thence leaving the River to the west, and following the brook valley in part, to the road by Spencer's. Thence passing an old mill on the brook, to the River, 100 rods below West Stockbridge village. Thence crossing the River to its right or west bank, and passing west of the village, and over some high ground to the Richmond road. Thence by Flat Brook, passing Crane's & Woodruff's, to the State line in Canaan. Distance from No. 36, in Dalton, 31 57-100 miles, and from Boston by this line, 174 9-100 miles.

TABLE

Of Distance and Inclinations of the Road, on the above described Route.

Dalton, Pittsfield, Lenox, Lee, Stockbridge, W. Stock.

Towns and Places Passed	No. of Sta.	Distance from Boston.	Length of Planes.	Ascent in each Plane.	Desc. in each Plane	Inclin. per Mile.	Height above Ct. River
		M. Ch. L.	Ch. L.	ft. 1-100	ft. 1-100	ft. 1-100	
From Stake No. 36 Dalton 1139 23 above Conn. River.	316	143 70.48	108.25	.	84.32	62.31	1054 91
	303	145 12.22	101.74	.	10.01	7.87	1044.90
Pittsfield . .	298	146 1.36	69.14	.	48.90	56.58	996.00
	295	146 21.77	20.41	10.89	.	42.68	1006.89
Road by Hull's house	291	146 58 77	37.00	.	20.66	44.67	986.23
	289	147 00.13	21.36	.	.	Level	986.23
Pass. Sacket's brook	284	147 33.56	33.43	.	14.23	34.05	972.00
	275	148 29.32	75.76	.	.	Level	972.00
	268	149 14.17	64.85	.	41.00	50.58	931.00
	266	149 32.86	18.69	.	.	Level	931.00
Lenox . .	263	149 59.18	26.32	.	18.00	54.71	913.00
Pass. Dewey's House	257	150 26.11	46.93	3,00	.	5.11	916.00
Cross. Hous. River	245	151 32.64	86.53	.	6.35	5.87	909.65
	242	151 67.49	34.85	6.95	.	15.95	916.60
	238	152 30.21	42.72	.	10.98	20.56	905.62
	228	153 32.27	82.06	7.38	.	7.19	913.00
	220	154 33.73	81.46	.	3.50	3.43	909.50
Pass. Lenox Furnace	212	155 11.06	57.33	.	21.16	29.52	888.34
	208	155 44.35	33.29	.	17.58	42.24	870.76
Passing Paper Mill	199	156 15.92	51.57	.	16.76	26.00	854.00
Church's Pond	192	156 45.81	29.89	.	.	Level	854.00
	187	157 2.68	36.87	.	14.32	31.07	839.68
Pass. Lee Village and	183	157 45.76	43.08	10.32	.	19.10	850.00
Dr Hyde.	175	158 33.51	67.75	.	27.62	32.61	822.38
Turnpike near toll h.	171	158 77.01	43.50	8.62	.	15.85	831.00
Passing Col. Hill	167	159 31.82	34.81	.	24.00	55.15	807.00
Cross. Housatonic R. twice and pass. Tremain's Tavern	153	160 58.75	106.93	.	7.00	5.23	800.00
Pass. S. Lee Village. Stockbridge.	149	161 16.29	37.54	.	15.00	31.96	784.00
Pass. near Bennett & Stevens	141	162 3.83	67.54	.	.	Level	784.00
By Williams' House	138	162 29.07	25.24	5.51	.	17.46	790.51
Pass. Stockbridge Village and crossing Housatonic River	131	163 18.51	69.44	.	13.51	15.56	777.00
By Lester's Factory	124	163 68.80	50.29	15.00	.	23.86	792.00
cross. Hous. River	121	164 16.64	27.84	.	11.00	31.61	781.00
Near Seley's factory	119	164 42.18	25.54	2.00	.	6.26	783.00
	112	164 76.42	34.24	22.06	.	51.54	805.06
	105	165 29.54	33.12		.	Level	805.06
By Mill Pond W. Stockbridge	99	165 49.02	19.48	.	7.33	30.10	797.73
S. Pt. of Stockbridge Mount.	83	166 44.29	75.27	75.27	.	80.00	873.00
Pass. Robbins' house	71	167 17.14	52.85	.	43.00	65.09	830.00
Pass. Marble Mills	63	167 72.58	55.44	.	21.00	30.30	809.00
	60	168 26.78	34.20	16.22	.	37.94	825.22

West Stockbridge to N. York State Line at Canaan.

Towns and Places Passed	No. of Sta.	Distance from Boston.	Length of Planes.	Ascent in each Plane	Desc. in each Plane.	Inclin. per Mile.	Height above Ct. River.
	57	168 54.66	27.88	.	9.57	27.46	815.65
Pass. Crocker's M.M.	52	169 12.52	37.86	16.60	.	35.08	832.25
" Marble Quarry	45	169 59.08	46.56	.	.	Level	832.25
" Spencer's House	34	170 71.06	91.98	33.75	.	29.35	866.00
By Marble Mill	30	171 22.82	31.76	.	24.00	60.45	842.00
Pass. W Stockbridge	26	171 66.33	43.51	23.00	.	42.29	865.00
Village.	23	172 13.70	27.37	.	7.00	20.46	858.00
Road . .	13	173 8.00	74.30	.	.	Level	858.00
N. Y. State Line	5	174 7.74	79.74	14.00	.	14.04	872.00
				270.57	537.80		
		Ascent . .		270.57			
		Descent . .		537.80			
		Total Ascents and Descents . .		808 37			

Summary of the various Inclinations on the Housatonic Route, with their lengths in Ch. & L.

Rates of Inclination in Feet	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	Ch. Links	M. Ch. L.
Planes ascending Westward ,	154.53	226.41	142.27	72.06	63.92	34.24		75.27	768.70=	9 48.70
" descending " ,	376.66	69.44	206.87	278.35	70.29	195.12	192.86		1389.59=	17 29.59
	531.19	295.85	349.14	350.41	134.21	229.36	192.86	75.27	2158.29=	
" Level . . .	.	.	.	.	.	.	.	.	367.22=	4 47.22
Total dist. from Dalton to N.Y. line	.	.	.	.	.	.	.	.	2525.51=	31 45.51
No. of ascending Planes .	3	5	2	2	2	1	0	1	16	
" descending "	4	1	5	7	2	4	3	0	26	
	7	6	7	9	4	5	3	1	42	
" Level . . .	.	.	.	.	.	.	.	.	8	

Whole number of Planes from Dalton to New York Line . . 50

NORTHERN ROUTE TO CONNECTICUT RIVER.

This line runs from Charles-street, in Boston, across Charles River to Cambridgeport. Thence to Leverett's Store, in Brighton. Thence crossing Charles River, by the new Watertown Road, to stake No. 107, in Watertown. Thence running North Westerly, and East of the Spring Hotel, crossing the main Road by Nathaniel Bemis', and by the School House over to Mrs. Gore's. Thence by the back Road, in part, to Waltham Plain, crossing the Brook North of Dr. Jackson's. Thence over the Plains, crossing the main Road, to the side hill, North of the new Road. Thence over the Ridge, near Hager's, and turning to the North, and passing near Deacon Warren's and Hobbs', in Weston, crosses the Lancaster Road, by Bigelow's, to the valley of Stoney Brook. Thence Westerly, crossing the Brook, by Nathan Hagar's and Allen's, to Sherman's Mills, in East Sudbury. Thence to Concord River, crossing it above the Bridge. Thence along flat ground, South of Jones', Wheeler's, and the old Indian Fort, in Sudbury, to Bent's. Thence passing to the North West of Maynard's, and 160 rods North of the Meeting-House, comes on to the Berlin Road. Thence along near the Road to the Poor House, in Marlborough, passing South West of Heart Pond, and North of White Pond. Thence through a corner of Stow, and by the North end of Jewell's Hill, leaving Rock Bottom Factory half a mile to the North, to Elzebeth or Asabet River, above the Bridge. Thence by the River to Feltonville, in Marlborough. Thence crossing the River below the Mills, and again half a mile above them, to the right bank. Thence by Brigham's, Bigelow's, and Sawyer's, to Deacon Job

Spafford's, in Berlin. Thence leaving the Elzebeth, and turning to the North West, the line follows the course of Berlin or North Brook, a branch of the Elzebeth, passing about one mile West of the Meeting-House, to top of the Ridge, West of West Boylston Road, near Lancaster Line. This Ridge may be avoided by keeping more to the South. Thence by Hastings' to the right bank of Nashua River. Thence in the valley of the Stream, passing Sawyer's Mills, and Lee's Factory, in West Boylston, to Beman's Tavern. Thence by the Nashua to the confluence of the Quinipoxet and Stillwater Rivers, which form the Nashua. Thence by the right bank of the Quinipoxet, passing South of Ball's Saw Mill, on Trout Meadow Brook, and crossing the River East of Eastabrook's, in Holden. Thence South of Eastabrook's house, and North of Lee's Factory, crossing the River to the right bank, to Lovell's Mills. Thence through the *French Woods* to Buffon's Factory. Thence crossing the Factory Pond, passing Quinipoxet Pond, Davis' Mill, Widow Wilson and Mason's Mills, to the summit in Princeton, South West of Widow Woodward's House. This summit is 968,92 feet above the Marsh level, and 54 11-100 miles from Boston, and divides the waters of Ware and Quinipoxet Rivers. Thence to Fay's Mill, on the Ware River, near the Barre Turnpike Gate. Thence by Ware River Valley, by Savage's Factory, Bigelow's House, and Dale's Grist Mill, to New Boston, in Rutland, near the mouth of Long Meadow Brook.

Thence by Brooks' to the River and Broad Meadows, in Barre, one mile North West of his house. Thence crossing the River and Meadows, to Rice's Mill Dam. Thence crossing the River again to right bank. Thence the line is over broken and rocky ground, for half a mile, where the river is

crossed again, and the line continued on the left bank and side hill to Newcomb's, near the mouth of Burnshirt Brook. Thence by the side hill, east of the River to the village of Sodom, in Oakham.

Thence crossing the River by the Bridge, the line is on the right bank to Clark's Factory, in Barre. From Clark's Factory, where the River is crossed, the line runs some distance East from the River, and North of Felton's, to Barre Plains. From Barre Plains, the River is soon crossed again, and the line carried West of the River, by White's & Winslow's, in the South part of Barre. Thence over plain ground, East of Col. Robinson's, in Hardwick, to the road a mile below his house. Thence to the Intervale land on the West or right bank of Ware River, at the junction of Moose Brook, near the Old Furnace, in Hardwick. Thence to the New Furnace, crossing the River half a mile above it, and keeping the left bank through Hardwick Gore, by Barlow's, to the River North East of Andrews' house, where it is crossed, and the line continued on the West side, to the Ware Factory Pond. Here the stream is crossed above the Dam, and the line winds round the cove East of the Factories, to the Cottage. Thence keeping South East of the River and Deacon Cummins' and over meadows and by side hill, to the Road leading by Lamberton & Babcock's Tavern, to Northampton.

Thence by the left bank of the River to stake No. 783, on the Plain., From this point to the pine tree on the side hill near Smith's Ridge, on the Palmer and Belchertown Road, the road would probably be located on the West sideof the River, but the survey was carried down by the left or East bank of the River, to Smith's house, and thence across the River to the Pine Tree. The distance is 2 1-2 miles, but by the new line, it pro-

bably would be less. The inclination from No. 783 to the Pine Tree, is made uniform in the table, but some variation would probably be necessary, in building the Road.

A survey was carried on from Smith's house, on the East side of Ware River, to Learnard's Mills, in Palmer, and crossing the River twice there, was continued on to the Chickapee, and up that River, to join the Springfield line, South of Sedgwick's Tavern.

From the Pine Tree on the West side of Ware River, to Bond's Mills, on Swift River, the Ridge lying between these streams was passed over, and Swift River crossed above Bond's Mills. The River valley is here broad and deep, being for 10 chains 45 or 50 feet below the surface of the Road.

Thence by Wright's and Allen's to Jabez Brook, and thence crossing the Brook, to the valley, half a mile South West of Belchertown Meeting-house. Thence through Clark's and widow Smith's land, and by North East and North side of Randall's hill, to Weston's house. Thence by Clark's Mill and the Forge on Bachelder Brook, to Rodney Ayres' on Bachelder-street, in Granby.

Thence North of Moody corner, in South Hadley, to Rock Ferry, on Connecticut River, passing a deep gully, by Moody's house, and a high ridge of rock West of it. This line from Moody's, is over very uneven ground, and should be avoided if possible. The distance of Rock Ferry on Connecticut River from Boston, by this route, is 106 7-100 miles.

TABLE

Of Distance and Inclinations on the above described Route.

Boston, Watertown, Waltham, Sudbury, Marlboro'.

Towns and places passed	No. of Sta.	Distance from Boston.	Length of Planes.	Ascent in each Plane.	Desc. in each Plane	Inclin. per Mile.	Height above Marsh.
		M. Ch L.	Ch. L.	ft. 1-100	ft. 1-100	ft. 1-100	ft. 1-160.
Fr. Charles st. Boston	136	127.73	107.73	.	.	Level	5.00
Passing Universal Church in Cambridgeport.	131	166.15	38.42	5.01	.	10.43	10.01
Charles River	127	224.30	38.15	.	5.01	10-43	5.00
Brighton	125	262.62	38.32	.	.	Level	5.00
Pass. Bramin's house	121	323.10	40.48	8.11	.	16.03	13.11
Charles River by Fisher & Jewett's. Watertown.	115	4 2.55	59.45	.	.	Level	13.11
	107	479.16	76.61	16.56	.	17.29	29.67
	38	523.20	24.04	.	7.03	23.39	28.64
By Bemis' House	28	633.29	90.09	14.21	.	12.61	36.85
	20	7 7.58	54.29	.	3.63	5.35	33.22
	16	747.94	40.36	.	.	Level	33.22
	14	775.62	27.68	4.48	.	12.95	37.70
	8	823.70	28.08	14.65	.	41.73	52.35
	3	913.32	69.62	9.73	.	11.18	62.08
	0	929.02	15.70	15.70	.	80.00	77.78
	10	10 2.54	53.52	53.52	.	80.00	131.30
Summit near Bear Hill	17	1042.92	40.38	25.38	.	50.28	156.68
Pass. Dea. Warren's. Weston	26	1118.44	55.52	.	35.62	51.33	121.06
Near Bigelow's	30	1136.21	17.77	18.00	.	58.52	134.06
" School House	35	1169.82	33.61	.	24.22	57.65	109.84
Cross. Stony Brook	38	12 4 99	15.17	.	.	Level	109.84
Lincoln	43	1245.58	40.59	34.72	.	68.43	144.56
Pass. Nathan Hagar	46	1270.40	24.82	11.50	.	37.06	156.06
	52	1320.27	29.87	.	9.00	24.10	147.06
Summit near Allen's	61	1371.66	51.39	50.00	.	75.89	197.06
	66	1421.55	29.89	.	6.80	18.20	190.26
East Sudbury	74	15 1.29	59.74	.	56.50	75.66	133.76
Pass. Sherman's mill	84	1567 23	65.94	.	18.70	22.69	115.06
Cross. Concord river	89	1617.76	30,53	10.00	.	26.20	125.06
Sudbury	92	1641.02	23.26	.	7.00	24.08	118.06
Pass. Jones & Abel Wheeler	96	17 3.82	42.80	3.77	,	7.05	121.88
	101	1745.50	41.68	10.77	.	20.67	132.60
	110	1813.98	48.48	38.46	.	63.46	171.06
	112	1836.22	22.24	.	.	Level	171.06
Pass. Sudbury M. H.	120	1932.51	76.29	.	7.00	7.34	164.06
" Heart Pond	126	2013.00	60.49	9.00	.	11.90	173.06
Road near Col. Fairbank's.	133	2053.89	40.89	21.50	.	42.06	194.56
	140	2148.13	74.24	.	2.95	3.18	191.61
Corner of Stow	144	22 0.70	32.57	9.45	.	23.21	201 06
Pass. White Pond	148	2243.51	42.81	.	8.00	14.95	193.06
By Marlboro' Poor H.	161	2362.66	99.15	13.50	.	10.89	206.56

Marlboro', Berlin, Boylston, Holden, Princeton.

Towns and places passed	No. of Sta.	Distance from Boston.	Length of l' anes	Ascent in each Plane.	Desc i each Plane.	Inclin. per Mile.	Height above Marsh.
		M. Ch. L.	Ch. L.	ft. 1-100.	ft. 1-100	ft. 1-100	ft. 1-100.
	167	24 28.29	45.63	.	12.50	21.92	194.06
	173	24 57.49	29.20	19.00	.	52.05	213.06
Pass. Jewell's Hill	184	25 64.17	86.68	.	6.00	5.54	207.06
Cross. Elzebeth river	188	26 14.60	30.43	.	7.00	18.40	200.06
	192	26 72.14	57.54	2.00	.	2.77	202.06
Passing Feltonville	201	27 67.11	74.97	10.00	.	10.68	212.06
Passing Brigham's	212	28 69.97	82.86	16.31	.	15.74	228.37
	217	29 36.19	46.22	.	.	Level	228.37
Berlin . .	220	29 64.64	28.45	7.69	.	21.62	236.06
Passing Sawyer's	228	30 42.67	58.03	.	10.09	13.91	225.97
" Dea. J. Spofford	233	30 79.42	86.75	12.80	.	27.86	238.77
Passing Brigham & Bowman	238	31 25.55	26.13	.	7.71	23.60	231.06
West of Berlin Meet-	254	33 12.19	146.64	71.00	.	31.91	302.06
inghouse.	257	33 47.81	35.62	7.11	.	15.97	309.17
Summit by Larkin's	270	34 53.48	85.67	61.89	.	57.79	371.06
Corner of Lancaster	279	35 51.90	78.42	.	23.93	24.28	347.13
Nashua R., Boylston	294	36 43.56	71.66	.	62.07	69.30	285.06
Near Gardner Smith's	299	37 16.19	52.63	7.00	.	10.64	292.06
Sawyer's Mills .	302	37 39.12	22.93	7.00	.	24.38	299.06
	309	38 22.78	63.66	2.00	.	2.51	301.06
	318	39 43.51	100.73	12.38	.	9.83	313.44
Beman's Tavern	326	40 60.83	97.32	22.62	.	18.59	336.06
Near confluence of Quinipoxet and Stillwater Rivers.	330	41 11.51	30.68	22.00	.	57.36	358.06
Holden . .	336	42 5.09	73.58	15.00	.	16.31	373.06
Along Quinipoxet R.	358	43 46.83	121.74	110.06	.	72.32	483.12
Near Eastabrooks'	370	44 29.85	63.02	47.94	.	60.85	531.06
	386	45 49.59	99.74	39.14	.	31.39	570.20
Pass. J. Lovel's Mill	396	46 32.71	63.12	14.91	.	18.89	585.11
French Woods .	403	47 4.33	51.62	35.23	.	54.59	620.34
" " .	418	47 67.37	63.04	30.72	.	38.98	651.06
Buffon's Factory	422	48 3.69	16.32	.	.	Level	651.06
	435	48 60.30	56.61	56.61	.	80.00	707.67
Pass. Quinipoxet P. Princeton	441	49 39.45	59.15	16.39	.	22.17	724.06
Davis' Mills .	446	49 73.99	34.54	.	7.00	16.21	717.06
	450	50 28.70	34.71	25.00	.	57.62	742.06
	453	51 1.32	52.62	9.00	.	13.68	751.06
Mason's Mills . .	458	51 43.43	42.11	22.03	.	41.85	773.09
	465	52 4.40	40.97	40.97	.	80.00	814.06
Summit in Princeton	468	52 30.99	26.59	15.06	.	45.31	829.12
	486	54 8.93	137.94	137.94	.	80.00	967.06
	489	54 34.28	25.35	.	12.48	39.38	954.58

Rutland, Barre, Hardwick, New Braintree, Ware.

Towns and Places Passed.	No. of Sta.	Distance from Boston.	Length of Planes	Ascent in each Plane.	Desc. in each Plane.	Inclin. per Mile.	Height above Marsh.
		M. Ch. L.	Ch. L.	ft 1-100	ft. 1-100	ft. 1-100	ft. 1-100.
	494	54 63.36	29.08	.	29.08	80.00	925.50
Fay's Mills . .	504	55 62.36	79.00	.	31.44	31.84	894.06
Rutland . .	507	56 3.79	21.43	.	18.00	67.19	876.06
	511	56 36.61	32.82	.	5.50	13.41	870.56
Bigelow's Mills .	521	57 53.42	96.81	.	.	Level	870.56
	555	58 16.07	42.65	.	40.00	75.03	830.56
	529	58 67.45	51.38	.	2.66	4.14	827.90
New Boston .	538	59 73.50	36.05	.	21.15	19.66	806.75
	541	60 24.99	31.49	.	11.44	29.06	795.31
Near Brooks' .	548	61 12.14	57.15	.	10.25	12.21	785.06
	550	61 37.60	25.46	.	.	Level	785.06
Barre . .	552	61 72.34	34.74	.	10.00	23.03	775.06
Near Rice's Mill, cross. R. twice	557	62 39.36	47.02	.	.	Level	775.06
Cross. Ware River	567	62 69.40	30.04	.	30.04	80.00	745,02
By Newcomb's .	582	63 69.43	30.03	.	33.96	33.94	711.06
By Damon's .	584	64 16.75	27.32	.	6.01	17,60	705.05
	590	64 64.46	47.71	.	31.99	53.64	673.06
Bridge at Sodom	597	65 62.42	77.96	.	23.35	23.96	649.71
Near Clark's Dam	599	66 8.60	26.18	.	.	Level	649.71
By Clark's Factory	602	66 33.50	24.90	.	9.15	23.39	640.56
	607	66 71.00	37.50	12.72	.	27.14	653.28
	614	67 46.61	55.61	.	18.08	26.01	635.20
	618	67 73.37	26.76	.	.	Level	635.20
	629	68 49.94	56.57	.	46.00	65.05	589.20
Pass. Barre Plains	641	69 32.41	62.47	.	21.01	26.91	568.19
Cross. Ware River	648	69 76.16	43.75	33.87	.	61.71	602.06
Near Mr Nye's	649	70 16.86	20.70	.	.	Level	602.06
Opposite Col. Robinson, Hardwick	652	70 55.77	38.91	.	11.98	24.63	590.08
	655	71 8.65	32.88	10.21	.	24.84	600.29
Road near Smith's	658	71 61.44	52.79	.	13.74	20.82	586.55
	661	72 9.12	27.68	.	12.99	37.54	573.56
Pass. Old Furnace and Moose Brook.	667	72 72.17	63.05	.	11.50	14.59	562.06
	675	73 34.97	42.80	.	.	Level	562.06
Against Cha's. Paige's	683	73 75.95	40.98	.	11.09	21.65	550.97
	689	74 69.27	73.32	.	.	Level	550.97
	693	75 38.51	49.24	.	4.59	7.45	546.38
	696	75 61.52	23.01	5.68	.	19.75	552.06
Cross. Ware R. New Braintree	700	76 16.34	34.82	.	8.26	18.98	543.80
Pass. New Furnace	712	76 77.71	61.37	.	7.74	10.09	536.06
The Gore . .	719	77 52.02	54.31	.	32.17	47.39	503.89
Corner of Ware	724	78 22.49	50.47	.	9.46	14.99	494.43

Palmer, Belchertown, Granby, South Hadley.

Towns & Places Passed.	No. of Sta.	Distance from Boston. M. Ch. L.	Length of lanes Ch. L.	Ascent in each Plane ft. 1-100	Descent in each Plane. Ft. 1-100	Incln. per Mile. Ft 1-100	Height above Marsh. ft. 1-100
Cross. Ware River	729	78 51.93	29,44	.	24.37	00.22	470.06
	731	79 6.21	34.28	2.00	.	4.67	472.06
	738	80 5.20	78.99	.	5.39	5.46	466.67
	740	80 27.58	22.38	.	6.41	22.91	460.26
By Upper Fac. Dam	746	80 79.32	51.74	.	.	Level	460.26
Near The Cottage	749	81 19.92	20.60	.	20.60	80.00	439.66
Ware Village	754	81 52.02	32.10	4.79	.	11.94	444.45
Near Gould's	762	82 64.06	92.04	.	50.87	44.21	393.58
	766	83 41.41	57.35	3.87	.	5.40	397.45
	772	84 1.41	40.00	.	17.89	35.78	379.56
	776	84 39.56	38.15	.	.	Level	379.56
Left Bank of Ware River—Palmer.	783	85 41.43	81.87	.	10.50	10.26	369.06
Pine by Durant's House	807	88 1.73	200.30	54.08	.	21.60	423.14
	811	88 28.57	26.84	26.84	.	80.00	449.98
	814	88 60.70	32.13	.	9.90	24.65	440.08
Bond's Mills	825	89 37.97	57.27	.	57.27	80.00	382.81
Belchertown	831	89 70.71	32.74	10.67	.	26.07	393.48
	835	90 32.20	41.49	.	4.80	9.25	388.68
	842	91 27.03	74.83	12.38	.	13.22	401.06
Near Wm. Wright's	846	91 59.81	32.78	17.00	.	41.49	418.06
	851	92 26.29	46.48	.	18.25	31.41	399.81
Jabez Brook	853	92 46.57	20.28	.	18.57	73.25	381.24
	858	93 5.40	38.83	32.84	.	67.66	414.08
	862	93 54.95	49.55	19.98	.	32.26	434.06
	867	94 5.14	30.19	30.19	.	80.00	464.25
Road by Walker's	871	94 38.73	33.59	.	.	Level	464.25
P. Belchertown V.	877	95 27.23	68.50	8.81	.	10.29	473.06
" Randall's Hill	897	97 20.50	153.27	.	153.27	80.00	319.79
	898	97 37.19	16.69	.	7.59	36.37	312.20
Crossing Bachelder	905	98 33.18	75.99	.	40.26	42.38	271.94
Brook, Granby.	906	98 58.77	25.59	.	.	Level	271.94
Passing Old Forge	911	99 32.15	53.38	.	11.88	17.80	260.06
	915	99 74.12	41.97	19.00	.	36.21	279.06
	917	100 18.27	24.15	.	16.00	53.02	263.06
By Elihu Clark's	919	100 38.93	20.66	1.61	.	6.23	264.67
House.	922	100 71.09	32.16	.	4.61	11.47	260.06
By Sugar Brook	925	101 23.31	32.22	4.00	.	9.93	264.06
	931	101 58.44	35.13	.	7.00	15.94	257.06
Near Robbin's	936	102 14.42	35.98	8.00	.	17.79	265.06
Woollen Factory.	940	102 61.27	46.85	.	.	Level	265.06
South Hadley	945	103 41.63	60.36	.	17.11	22.67	247.95

South Hadley to Rock Ferry on Conn. River.

Towns & Places Passed	*No. of sta.*	*Distance from Boston.*	*Length of Planes.*	*Ascent in each Plane*	*Desc. in each Plane.*	*Inclin. per Mile.*	*Height above Marsh.*
		M. Ch. L.	Ch. L.	ft. 1-100.	Ft. 1-100	Ft 1-100	ft. 1-100.
Pass. Moody Corner	951	104 6.39	44.76	.	44.76	80.00	203.19
	953	104 41·75	35.36	.	10.72	24.25	192.47
	959	105 11.08	49.33	.	33.52	54.36	158.95
	966	105 36.84	25.76	25.76		80.00	184.71
Conn. R. at Rock F.	978	106 5.58	48.74	.	48.74	80.00	135.97
Total Ascents and Descents .				1634.12	1503.15		

Summary of the various Inclinations on the Northern Route, to Connecticut River, with their lengths in Chains and Links.

Rates of Inclination in Feet	0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	Ch. Links	M. Ch. L.
Planes ascending Westward .	409.24	1269.68	555.48	425.76	170.45	290.03	234.67	560.66	3915.97=	48 75.97
" descending "	512.60	859.44	863.37	315.23	222.34	210.32	179.10	506.43	3668.83=	45 68.83
	921.84	2129.12	1418.85	740.99	392.79	500.35	413.77	1067.09	7584.80	
" Level . . .	.	.	.	.	.	.	.	.	900.78=	11 20.78
Total dist. from Boston to Conn. River.	.	.	.	.	.	.	.	.	8485.58=	106 5.58
No. of ascending Planes .	8	21	11	6	5	7	5	10	=73	
" descending "	8	18	20	7	3	5	4	10	=75	
									148	
" Level . . .	.	.	.	.	.	.	.	.	21	

Whole number of Planes from Boston to Conn. River . . . 169

The foregoing are all the Tables of the heights, distances, Inclinations, &c. relative to the Planes of the Road, as represented by the Red Lines on the Profiles. But as these will not so definitely give the heights and distances of particular points on the survey, many of which are either above or below the Plane of the Road, I have thought that it would be interesting to the Public and not unimportant to the Board, in making comparisons of Routes, and of Branches of the main line, to have a Table inserted, which might furnish some data for other calculations.

I have not had an opportunity of testing the accuracy of all the Levels; but from two or three comparisons which I made, I think they are generally as correct as would be expected from the nature of the Surveys. By the line from Dalton through Richmond to Canaan, and thence back through Stockbridge, Lenox, &c. to Dalton again, being a circuit of about forty eight miles, the difference of the levels was only one foot and twenty five hundreths. And on the Southern Route, from the marsh level in Cambridgeport to Palmer, and by the north Route through Princeton to the same marsh level again, a circuit of 173 miles, the level corresponded into one foot and nineteen hundreths. Other shorter lines differed but a few inches.

Table of Distances and Heights by the Southern Route from Boston to Connecticut River.

No. of Sta.		NAMES OF PLACES.	*Distances from Boston.*	*Heights above Marsh.*
			M. Ch. L.	ft. 1-100.
M. H.	73	Top of underpinning of Rev. Mr Greenough's Meeting house - - - Newton	8 23.23	49 93
	116	Charles River below Newton lower Falls do	10 64.10	32 17
	130	Elm bench N. of White & Sargent's Tavern, Needham	11 59.16	139 61
	148	Noyes & Kingsbury's meadow - - do	13 19.22	118 72
	152	Path front of Mrs Flagg's house - do	13 44.39	138 05
	161	Stevens' Garden - - - do	14 31.06	154 52
Outlet	170	Morse's Mill Pond by Mills - - do	14 57.91	114 66
	179	Bench on Rock, top of Goodnow's Ridge, Natick	15 46.57	205 98
	187	Appletree Bench by Meetinghouse - do	16 26.15	172 87
Peg	202	Long Pond at mouth of Brook - - do	17 26.91	129 42
Inst.	211	Road by Walker's Mills - - do	18 12.35	
	212	Appletree Bench by Thomas's House - do	18 34 55	158 83
Brook	218	Beaver Dam Brook by New Turnpike - do	18 79.48	144 20
	230	Farm Pond by " " Framingham	20 28.50	150 47
Inst.	238	Baptist Meetinghouse - - do	21 9.15	
Peg	242	Road by large Elm near Merrick's house do	21 54.97	167 96
	244	Framingham and Holliston Line - do	21 59.23	
	251	Top of Shepherd's Mill Dam Concord Riv. do	22 37.57	168 90
Inst.	269	Bigelow's Mill Pond " do	24 47.43	201 28
	276	Wall and C'y line between Framingham & Southboro'	25 23.95	225 51
	284	Meadow by Bullard and Whiting's Mill do	26 9.69	229 81
	301	Morse's Mill Pond on Concord River Westborough	27 61.69	269 78
	325	Great Meadow in - - - do	30 27.81	275 95
	331	Road by Boardman's Barn (Meadow 280.39 ft.) do	30 71.73	
	340	Appletree Bench by Warren's house do	31 65.45	309 12
	344	Harrington's Mill Pond on Elzebeth River do	32 5.68	285 12
	364	Charlestown Meadow Brook below Road, S. E. of Col. Brigham's - - - -	33 66.83	305 44
	376	Town line by Kimball's House between Westborough and Grafton	34 68.00	
Sum.	384	Summit, Bench on Rock in Road in front of Moses Cutler's house - - - do	35 50.03	410 28
	410	New England Factory Pond at Indian Weirs do	37 30.11	353 57
	427	Town line between Millbury and - Worcester	38 65.00	
	460	Ridge by Gray's house - - do	40 64.40	515 88
	474	Rail Fence on Ridge by Trumbull's - do	41 62.04	544 68
	482	Water of Blackstone Canal by Brewery do	42 24.21	453 88
Canal	57	Bottom of " " below Lock do	42 49.21	441 46
	34	Bench on Butternut in Tatnick Brook Valley do	44 27.24	474 26
	4	Elm Bench at Fork of Roads by Jones' Tav. do	45 53-64	609 12
	539	Town line at Kettle Brook, between Worcester and Leicester	46 24.88	
Inst.	541	Sargent's Mill Pond - - - do	46 38 83	682 28
	545	Platform of Bottomly's Factory - do	46 79.53	714 49
Inst	3	Bottom of Sill of Henshaw's barn top of Ridge do	47 77.60	832 42
	5	Meadow West of Henshaw's Ridge - do		790 36
	584	Livermoore's Ridge at Road - - do	49 51.14	850 61
	591	Sadler's Meadow and Brook - do	50 1.30	806 54
Inst.	595	Haven's Mill Pond - - - do	50 22.08	830 25
Inst.	603	Kingsbury's House - - - do	50 78.02	

Table of Distances and Heights by the Southern Route from Boston to Connecticut River.

No. of Sta.		NAMES OF PLACES.		*Distances from Boston.*	*Heights above Marsh.*
				M. Ch. L.	ft. 1-100
Inst.	616	Jones' Mill	Spencer	52 04 49	
	618	Watson's Mill Pond	do	52 24.81	866 85
	629	Appletree Stump at Road, Grout's Summit	do	53 25.54	918 22
	47	Cranberry Meadow Brook, S.E. of Bemis' Tav.	do	56 44.93	622 55
	62	Oak Tree at the line between Spencer and Brookfield		57 39.96	639 61
	66	Gallop's Mill Pond on Seven Mile River	do	57 67.56	612 81
	74	Seven Mile R. by I. Sleighton's Card. Machine	do	58 23.68	598 90
	82	Five Mile River at Furnace 1.20 ft. above Podunk Pond	do	58 53 32	595 85
	99	Moore's Brook	do	60 29.85	598 76
	734	Meadow, by Olds' Bridge	do	61 40.04	595 05
	740	Bench on Great Oak on Intervale S. of M. H.	do	62 04.39	600 94
	767	Chickapee Riv. S.W. of M. H. West Parish	do	65 00.70	593 77
	772	Bench on Ash in Road by Dean's House	do	65 44 14	601 19
	774	Town line between Brookfield W. Parish &	Western	65 59 76	
	795	Fuller's Factory Pond at Western 'City'	do	67 41.45	589 50
	800	Moores' Mill Pond at Old Forge	do	68 03.07	581 94
	809	Top of Great Rock, right bank of Chickapee River below Partrick's Bridge 11.55 ft. above water	do	69 11.01	559 38
	816	Bench on Rock at Road by S. Blair's Bridge	do	69 69.08	531 98
	819	Chickapee River below " "	do	70 04.35	499 88
Inst.	838	Hodges' Old Mill	do	71 41.41	
	853	Town line between Western and	Brimfield	72 68.05	398 80
Inst.	859	Samuel Shaw's House	do	73 42 87	
	865	Walnut Bench N.E. of Col. King's	do	74 28.54	383 18
Inst.	867	Road to Col. King's Bridge	do	74 48.39	
	875	Chickapee River below Col. King's	do	75 46.29	348 51
	888	Blanchard's Mill Pond	Palmer	77 14 37	328 98
Inst.	908	Sedgwick's Tavern	do	79 71.11	
	912	Appletree bench, left bank of Chickapee Riv. below bridge, 4,80 ft. above water	do	80 17.84	302 39
	10	Summit in Shearer's Meadow	Monson	80 66.28	369 04
	25	Bench on Elm on Conn. State Farm	do	82 13 07	329 37
	31	Town line between Monson and	Wilbraham	82 47.04	
	40	Shearer's Mill Pond	do	83 24.21	245 38
	48	Bench on Elm near the mouth of Twelve Mile Brook, 7.12 ft. above Chickapee R.	do	83 57.58	221 45
Inst.	60	Cross Road to Ludlow	do	84 34.80	
Inst.	102	Town line by Fuller's House between	Wilbraham and Springfield	87 51.01	
	136	Cedar Bench in Swamp	do	90 16.84	197 25
	161	Old Boston Road	do	91 65.48	223 29
	168	Bench on Pitch Pine at Chickapee Road	do	92 30.57	204 30
	177	Elm Bench on bank of Garden Brook	do	92 60.19	141 78
	190	Garden Brook Valley east of Main Street	do	94 12.96	57 49
	192	Poor House Garden	do	94 24.32	69 70
	197	Conn. R. 3-4 mile above bridge, 16.62 ft. lower than the Jefferson Flood in March 1801, and 5 or 6 feet above low water mark	do	94 64·25	39 48

Table of Distances and Heights from Connecticut River to Canaan, New York.

No. of Sta.	NAMES OF PLACES.			Distances from Boston.	Height above Ct. Riv.
				M. Ch. L.	ft. 1-100.
2	Road by Widow Frink's house	West Springfield		95 9.88	15 81
13	Ashley, Parsons' & White's Mill Pond on Westfield River	do	do	96 2 85	13 07
29	Block Brook	do	do	97 10.97	
33	Bench on White Oak 32.50 ft. above River at head of the Falls	do	do	97 36.67	84 42
52	Elm Bench W. side great Road by watering place	do	do	99 40.98	78 72
Inst. 63	Line between West Springfield and by Blacksmith's Shop near Morley's Bridge		Westfield	100 22.85	
63	Bench on Morley's Sign Post 22,39 ft. above River at the Bridge	do		100 27.58	81 96
64	Buttonwood Bench by Morley's Tavern	do		100 33.88	83 90
71	Elm bench by Harrington's house	do		101 8.49	83 81
Inst. 85	Fordway Lane	do		102 51.89	
Inst. 94	Road against Aqueduct and surface of H. & H. Canal	do		103 45.27	103 00
113	Appletree Bench in Martin Tinker's land	do		105 28.76	126 48
Inst. 119	Top of underpinning of School house by Hon. J. Fowler's Farm House	do		106 3.10	158 53
122	Montgomery Brook at mouth of Little Brook	do		106 20.85	135 15
130	By line of Canal Feeder	do		106 79.70	177 56
139	Westfield river by Wheaton's	Russell		107 40.09	122 07
161	Sill of Mallony's Barn	do		108 63.76	188 58
166	Appletree Bench by Dickinson's house near Feeder Dam	do		109 18.69	192 09
183	Appletree Bench by Doolittle's House	do		110 40.49	209 80
185	Barker's Toll Gate	do		110 58.91	220 60
193	Hemlock Bench by Brook above the Narrows	do		111 21.18	233 61
218	Elm Bench 2.91 ft. above Westfield River	do		112 43.30	233 17
225	Button Wood Bench by Culver's house	do		113 15.80	267 15
236	Chesnut Bench 19.60 ft. above Gould's Mill Pond	do		114 4.68	302 86
242	Town line between Russell and	Blanford		114 39.14	
252	Bottom of Sill of Esq. Wade's barn, Chester Village, 3 ft. above ground	Chester		115 46.23	327 25
Inst. 266	Road to Fordway, by line between Blanford and	do		116 59.10	
289	Appletree bench by Walton's house	do		118 67.36	434 65
319	Smith's Garden	do		121 22.65	508 90
322	Road by Glass House	do		121 51.78	526 77
Inst. 328	Walker's Brook Bridge	do		122 06.13	551 14
330	Appletree bench by Col. Henry's Tavern, 7.10 ft. above Westfield River	do		122 26.54	552 66
335	Bench on Elm west side Road, 10.03 ft. above Fay's Pond	do		122 69.42	585 34
344	Elm Bench front of Wait's house	do		123 57.24	630 65
358	Westfield River above Root's Bridge	Middlefield		124 70.59	683 88
369	Bench on Beech by old Grist Mill Canal	do		125 55.14	731 70
388	Westfield River at the mouth of Leach's Brook	do		127 03.75	821 05
402	" " under Becket Bridge	Becket		128 3.65	901 59
418	" " by Clark's house	Middlefield		129 13.24	1007 63
437	" " and Stevens' Mill Pond	Becket		130 67.46	1148 38

Table of Distances and Heights from Connecticut River to Canaan, New York.

No. of Sta.	NAMES OF PLACES.		*Distance from Boston.*	*Heights above Ct. Riv.*
			M. Ch. L.	ft. 1-100
438	Westfield Riv. and Norton's Mill Pond	Becket	130 72.51	1155 09
444	Hemlock bench near line bet. Becket & Washington		131 18.74	1165 81
460	Intervale by old house cellar -	do	132 31.44	1236 12
Inst. 469	Road by Crane's house - -	do	133 15.68	
478	Elm bench in Ravine - - - -	do	134 08.80	1342 14
487	Appletree bench Washington Summit	do	134 28.53	1440 64
14	Bench on Hemlock 1.22 ft. above Mud Pond	do	135 08 73	1394 56
17	Town line between Washington and -	Hinsdale	135 32.78	
59	Merriman's Mill Pond on Housatonic river	do	139 41.68	1379 01
66	Fay's Mill Pond - - -	do	139 70.04	1334 34
0	Peg No. 72 on side hill - -	do	140 24 65	1320 12
25	Bench on Oil Nut - - -	Dalton	141 58.67	1204 47
36	Against Dalton Meetinghouse - -	do	142 42.22	1143 35
115	Appletree bench by Chamberlain's house	do	143 70.47	1073 28
125	Town line between Dalton and -	Pittsfield	144 59 02	
132	Bass-tree bench on left bank of Housatonic River, 8.11 ft. above water - -	do	145 35.32	943 74
145	Sill of Gen. Root's Factory - -	do	146 79.38	947 38
155	White's Mill Pond on Housatonic Riv.	Pittsfield	147 75.38	928 44
158	Bench on Bass tree in Col. McKay's land	do	148 22.71	935 08
164	Oak bench right bank of Pontoosic River	do	148 70.89	930 99
207	Shakers' Mill Pond - - -	do	152 10.36	1053 18
213	Maple bench in Burt's land - -	do	152 55.38	1091 50
225	Town line between Pittsfield and -	Richmond	153 51.76	
231	Appletree bench at Hartford & Albany Turnp.	do	154 34.26	1090 82
242	Door step of Rev. Mr Dwight's house -	do	155 48.42	1110 02
264	Appletree bench by Leadbetter's house	do	157 17.78	1006 87
286	Cherry tree bench in Road by Hackley's house	do	158 22.78	962 64
302	Corner of Roads by Samuel Arnold's house	do	159 43.79	916 56
316	New York & Massachusetts Line dividing Canaan from W. Stockbridge Peg 316		160 44.12	924 63

Hoosic Route from Dalton to Petersburgh, New York.

From P. 36				
43	Housatonic river below Old Furnace -	Dalton	142 73.83	1038 82
44	Road by Shop - - - - -	do	143 3.03	1079 96
51	" on Plain - - - - -	do	143 57.07	
61	Peg No. 21 old line - - -	Pittsfield	144 28.71	1053 81
42	Brook-head of Hoosic river, near line of Pittsfield and - -	Lanesborough	146 13.42	957 92
47	Brook and Powell's Mill Pond -	do	146 39.70	974 40
57	Maple bench by Hoosic R. 2 20 ft. above water	do	147 03.30	947 39
Inst. 67	Comans' Mill Pond - - -	do	147 65.47	942 75
75	On Meadow & Town line bet. Lanesboro' & Cheshire		148 36.57	933 45
90	Hoosic River - - - -	do	150 02.90	920 32
104	Oil nut by Cheshire Village - -	do	151 61.96	938 76
Inst. 109	Hoosic River at Bridge do - -	do	152 21.88	910 15
129	" " and Jenks' Factory Pond -	do	154 52.36	891 39
Inst. 132	Top of underpinning of Jenks' Factory -	do	155 06.47	891 37
133	Town line between Cheshire and -	Adams	155 14.88	

Table of Distances and Heights from Dalton by Hoosic Route to Petersburgh, New York.

No. of Sta.	NAMES OF PLACES.		*Distance from Boston.*			*Height above Ct. Riv.*	
			M.	Ch	L.	ft. 1-100.	
Inst.	155 Jenks' Mill Pond	Adams	156	79.54		760	74
	156 Fence by Robinson's house near Bridge 1 foot above ground, S. Adams Village	do	157	12.90		756	81
	158 Top of underpinning of Anthony's brick Cotton Factory 5 feet above Canal	do	157	37.63		748	17
Inst.	161 Turner's Factory Pond	do	157	55.95		727	67
	186 Ash bench at Road by Browning's house	do	161	28.12		674	84
Inst.	197 Colgrove Mill Pond	do	162	52.53		654	12
	210 Hoosic river by Jones' Bridge, North Village	do	164	2.46		606	16
	220 Road by B. Hopkins' H 5.60 ft above Mill Pond	do	165	39.96		579	68
	223 Fork of Roads by E. Hopkins' house	Williamstown	165	75.01		575	08
Inst.	233 Hoosic River at Noble's Bridge 12·84 ft. below top of cross Stringer of Bridge	do	167	28.73		543	24
	243 Simonds' Bridge	do	168	30.67			
	254 Elm bench at Surface of River	do	169	42.60		516	79
	255 Line by Ware's Brook between Massachusetts and Vermont,	Pownal	169	49.14			
	282 Road front of Josiah Bates' house	do	172	68.68		491	56
	294 Water of Brown's Mill Pond	do	174	26.16		465	05
	304 Top of Mon. Stone, left bank of Hoosic R. at Vosburgh's bridge 8.83 ft. above R. & 5.13 below top of underpinning of Vosburgh's house.	Petersburgh New York	175	71.80		452	06

On Housatonic Route from No. 36 Dalton to Canaan New York.

	316 Side hill opposite Appletree bench No. 115 by Chamberlain's and 14.86 above bench	Dalton	143	70.48		1088	14
	298 In Road the line between Dalton and	Pittsfield	145	76 11		998	81
	291 Turnpike	do	146	58 77		977	41
	284 Valley of Sackett's Brook 100 Rods above Barnard's Mill	do	147	37.13		956	44
	276 West side Road by School H.	do	148	18.99		966	97
	258 Road by Dewey's House	do	150	13.56		913	12
	253 Water of Housatonic River	do	150	57.97		900	91
	237 Bowen's Road	Lenox	152	45.28		903	14
	219 Elm Bench at Lenox Furnace 8.47 above Pond	do	154	46.53		899	40
	213 By line between Lenox and	Lee	155	04.97		889	61
	204 By Paper Mill Pond	do	155	70 85		857	63
	191 Church's Mill Pond and Mills	do	156	51.38		842	79
	189 At Ball, Bassett & Co's Woollen Fatory on Scott Pond Brook	do	156	62.12		841	46
	185 Housatonic at Lee Village Bridge	do	157	24 86		826	83
	172 At Turnpike S. W. of Toll House by Col. Hills	do	158	65.91		827	42
	161 Housatonic River east of Davis' house	do	160	02.89		793	78
	158 River Road by Davis' house	do	160	20.79		813	80
	157 Housatonic River against Tremain's Tavern	do	160	32.15		793	71
	151 Owen's Paper Mill Yard	do	160	70.53		794	92
	150 Line between Lee and	Stockbridge	161	06.09			
	138 Street by Mr Williams' Stocbridge Vil.	do	162	29.07		790	51
	126 Housatonic River at Lester's Bridge	do	163	50.19		768	33
	119 " " and Seley's Mill Pond	do	164	42.18		762	04

On Housatonic Route from No. 36 Dalton to Canaan, New York.

No. of Sta.	NAMES OF PLACES.		Distances from Boston.	Heights above Ct. Riv.
			M. Ch. L.	ft. 1-100.
106	Oak Bench by Marble Ledges -	Stockbridge	165 26.17	805 06
99	Mill Pond - - - -	do	165 51.56	769 02
90	Line between Stockbridge and	West Stockbridge	166 24.77	
84	White Oak bench on S. Point of Stockbridge Mountain - - - -	do	166 43.38	874 61
63	Road by Bridge over Williams' River -	do	167 72.58	805 78
53	Crocker's Marble Mills and Pond -	do	169 05.10	826 14
48	Hemlock bench by Mill Dam 2 ft. above Pond	do	169 37.84	830 21
35	Ash bench by Spencer's house -	do	170 60.95	861 58
30	Williams' R. below West Stockbridge Village	do	171 17.15	834 63
27	Upper Mill Pond at Road - -	do	171 48.15	850 15
14	Meadow E. side Road by J. Crane's house	do	172 79.80	852 36
6	Road by Bridge near Woodruff's -	do	173 68.32	865 30
4	Peg 34 links W. of N.Y. State Line -	Canaan	174 7.74	868 73

From Viets' Summit in Becket to Peg 172 on Housatonic Route.

	0	Bench on Maple on Viets' Summit in	Becket		1680 60
	6	North side of Turnpike W. of Viets' house	do	57.12	1623 82
	55	Thomas' Mill Pond at Mills - -	do	3 7.32	1490 06
	72	South west side Turnpike near Dr. Soule's	do	4 26.68	1390 93
	84	Hemlock bench in Swamp N. E. of Chaffee's Tav.	do	5 11.64	1328 64
	93	Green Water Pond at S. end by Turnpike	do	6 13.54	1330 60
	102	Green " River at Bacon's Mills near line of Becket and - - - -	Lee	7 16 17	
Inst.	111	Green Water Riv. by old Mill site W. of Shaylor's Tavern - -	do	7 66.15	1294 07
Inst.	122	" " " at Bridge E. of Eph. Shelden's	do	8 75.10	1209 13
	130	Basset's house - - - -	do	10 02.92	1125 17
	147	Green Water Riv. above Junction with Goose Pond Brook - - - -	do	11 03.88	938 08
Inst.	150	Water of Whiton's Mill Pond - -	do	11 22.49	912 57
	154	Beach's Machine Shop Pond - -	do	11 57.35	851 01
	158	Housatonic R. at Bridge above the mouth of Green Water River 7.57 below plank of bridge	do	12 11.52	816 40
	172	Peg No. 172 Housatonic survey by Turnpike S.W. of Toll House by Col. Hill's - -	do	13 09.54	827 42
		State line in Canaan - - -	do	28 31.03	868 73

Northern Route through Princeton from Boston to Conn. River at Rock Ferry.

Showing the Distances from Boston and Height above the Marsh.

	115	Top of west end of Bridge over Charles River by Fisher and Leverett's Store	Brighton Watertown	3 74.43	6 91
40 &	107	Peg No. 107 in New Road fr. Cambridgeport to	do	4 79.16	29 67
	36	S. side of Road by Russell Sprague's house	do	5 54.34	38 29
	28	N. side Road by N. Bemis's H. in the Village	do	6 33.29	39 56
Inst.	13	W. bank of Brook by Dr Jackson's house	Waltham	8 03.47	
	0	Walnut bench on side hill N. of School house	do	9 29.02	75 26
Inst	9	Top of Hagar's Ridge - -	do	9 70.20	136 87
	18	Bench on White Oak on Summit in Woods	do	10 48.51	157 30
	21	Line between Waltham and -	Weston	10 63.95	

Northern Route through Princeton from Boston to Conn. River at Rock Ferry.

No. of Sta.	NAMES OF PLACES.		*Distance from Boston.*	*Height above Marsh.*
			M. Ch L.	ft. 1-100.
27	Stowell Brook by Warren's house	Weston	11 19.32	96 01
30	Top of Ridge by Bigelow's house	do	11 36.21	138 87
36	Stony Brook	do	11 73.27	100 67
61	Summit between Charles and Concord Rivers	do	13 71.66	208 43
79	Sherman's Mill Yard	East Sudbury	15 29.22	122 55
83	Concord River above Bridge	do	15 61 34	106 99
105	By Hunt's house	Sudbury	17 69.88	147 07
122	Road by west end of Heart Pond	do	19 52 94	
145	By north end of White Pond	Stow	22 14.08	186 47
147	By line between Stow and	Marlborough	22 37.54	192 57
160	Poorhouse Garden	do	23 55.56	204 29
174	East side Jewell's hill by cross road	do	24 66.08	219 62
187	Elzebeth R. 7.35 ft. below top of Cap of east abutment of Bridge E. from Feltonville	do	26 02.40	187 83
195	Feltonville and Wood's Mill Pond	do	27 19.77	200 83
206	Road by Brigham's Bridge	do	28 25.35	217 78
218	Line between Marlborough and	Berlin	29 48.95	
224	Meadow by Amos Sawyer's	do	30 08.14	218 36
237	Col. Parks' Mill Pond on Berlin Brook	do	31 21.11	221 81
Inst. 248	Fork of Roads	do	32 53.98	
258	By School House	do	33 55.49	313 25
264	Brook at Temporary Dam	do	34 06.27	313 24
Inst. 270	Summit bench on Appletree by Larkin's	do	34 53.48	383 21
276	Maple bench in meadow by Lancaster line	Boylston	35 28.88	354 38
290	White oak bench at Road on left bank of Nashua River	do	36 17.18	322 41
295	Maple bench on Ditch bank on Intervale	do	36 53.16	284 70
301	Bench on white oak at Sawyer's mill 10.63 ft. above river below dam & 0.58ft. above M. Pond	do	37 35.95	294 03
316	Road on Narrow ridge by old house	West Boylston	39 20.49	
322	Bench on Elm on Intervale 4.25 ft. above Canal from Lee's Factory	do	40 15.09	322 78
326	Road on Intervale by Beman's Bridge	do	40 60.83	332 89
331	Hathorn's Mill Pond	do	41 18.23	346 86
335	Peg 1 ch S. E. of Road by Silas Newton's	do	41 68.43	373 37
361	Oak bench on left bank of Quinipoxet river	do	43 66.19	491 98
Inst. 376	Quinipoxet River above Ball's Mill	Holden	44 52.23	533 23
387	Elm bench by Mr Eastabrooks'	do	45 56.27	576 66
389	Quinipoxet River at Eastabrooks' Bridge	do	45 66.26	557 91
Inst. 398	Lovell's Mills	do	46 51.68	
419	Brook from Bear Swamp in French Woods	do	47 69.94	
435	Top of underpinning of Buffon's Factory 4.08 ft. above Factory Pond		48 60.30	707 75
Inst. 444	Quinipoxet Pond by line between Holden & Princeton		49 57.15	711 59
449	Davis' Mill Pond	do	50 23.22	737 14
453	Meadow by Road east of Hagar's house	do	51 01.32	748 47
Inst. 465	Mason's Mill Pond	do	52 04.40	814 23
Inst. 477	Road from Rutland and Hubbardston to Princeton	do	53 25.18	

From Boston to Conn. Riv. by Northern Route through Princeton.

No. of Sta.		NAMES OF PLACES.		Distance from Boston. M. Ch. L.	Heights above Marsh. ft. 1-100
	485	Princeton Summit S.W. of Wid. Woodward's H.	do	54 01.23	968 92
	498	Fay's Mill Pond on Ware river	do	55 32.82	902 62
Inst.	506	Savage's Factory Pond by Blacksmith's Shop	do	55 71.82	877 01
	509	Hubbardston Brook near its mouth	do	56 23.20	865 00
	520	Fork of Roads at Bigelow's Mills on Ware River 8.80 ft. above Mill Pond	Rutland	57 49.34	871 05
	529	Bench on large Rock Maple E. side Hooker Hill	do	58 67.45	827 90
Inst.	538	Dale's Mill Pond on Ware R. New Boston	do	59 65.59	804 19
Inst.	548	Road by Brooks' Bridge	do	61 04.78	
	556	White Pine bench at Rice's Mills 4.50 ft. above Mill Pond	Barre	62 35.32	774 58
	565	Ware River below Old Factory	do	62 62.03	712 59
	584	Road front of Chase's house	do	64 16.75	705 05
Inst.	600	Clark's Factory Pond at Dam	do	66 12 64	646 02
	612	Road foot of Felton's Hill	do	67 24.15	
Inst.	638	Road by School house on Barre Plains	do	69 6.53	
	642	Ware river west of do	do	69 35.67	565 61
	648	Summit in Meadow by floom	do	69 77.00	601 85
	651	Line between Barre and	Hardwick	70 39 30	
	658	Road by Smith's house S. of Col. Robinson's	do	71 61.44	586 55
	666	Meadow on right bank of Ware River by Old Furnace 2.75 ft. above water of River	do	72 59.51	555 65
	699	River and New Furnace Pond	do	76 04.65	535 63
	705	New Furnace Dam	New Braintree	76 40.59	
	710	Anderson's Mill Pond	do	76 68.01	526 71
	724	Line between Hardwick Gore and	Ware	78 19.91	
	728	Water of Ware River	do	78 46.14	464 55
Inst.	746	Ware Factory Pond at Dam	do	80 69.36	454 49
	751	Road by Ware Factory Cottage	do	81 26.13	
	764	Road by Bridge over Ware R. below Factory	do	83 16.43	393 30
	777	Maple bench N. side road leading by Lamberton's	do	84 66.59	373 64
	783	Peg No. 783	Palmer	85 41.43	373 14
	807	Bench on Pitch Pine S. side road on side hill 68.53 ft. above R. at Elihu Smith's Bridge	do	88 14.73	423 14
	812	Bench on double Oak on Summit by Webb's H.	do	88 30 34	448 11
	825	Bond's Mill Pond on Swift R. which divides Palmer from	Belchertown	89 37.97	334 56
	842	Bench on Walnut S. E. of Wright's house	do	91 27.03	397 71
	854	Jabez Brook meadow	do	92 50.39	369 99
	860	West side of Road on Plain	do	93 31.68	421 19
	874	Oak bench in Meadow S. W. of M. H. (summit)	do	95 05.10	468 49
	897	Meadow and Brook E. of Weston's house	do	97 08.05	320 24
	904	Line between Belchertown and	Granby	98 18.57	
	908	Clark's Mill Pond	do	99 00.76	263 23
	912	Bachelder Brook Meadow	do	99 35.72	252 77
	918	E. side Bachelder Street by Rodney Ayres' H.	do	100 29.56	263 67
	929	Castleborough Brook at corner of Roads	do	101 46.79	
	937	Road to Robbins' Woollen Factory	do	102 25.16	266 56
	943	Line between Granby and	South Hadley	103 12.53	252 72
	946	Plain north of Moody's Corner	do	103 53.00	244 25
	952	Appletree bench on Plain	do	104 22.82	199 14
	956	Plain by Moody's house	do	104 77.01	172 77
	966	Top of Ridge in Road	do	105 38.68	216 17
	978	Connecticut River at Rock Ferry	do	106 05.58	92 97

From Peg No. 783 in Palmer to Southern Route at Sedgwick's.

No. of Sta.	NAMES OF PLACES.		*Distances from Boston.*	*Height above Marsh.*
			M. Ch. L.	ft. 1-100.
799	Newell's house - - - - - -	Palmer	87 27.82	
803	Bench on Rock south of Elihu Smith's -	do	87 70.19	370 23
821	Learnard's Mill Pond and Factory -	do	89 12.77	344 41
Inst. 838	Road from Three Rivers to Palmer -	do	90 67.18	
847	Ware River at Dumplin Hill - - -	do	91 62.42	297 01
861	Bench on AshNo. 5, S. line N. side of Road Palmer and Monson line,) by Sedgwick's	Monson	92 62.39	341 26
197	Connecticut R. above bridge at Springfield	Springfield	107 18.34	39 48

From Massachusetts Line to Hudson River.

Showing the Distances from Boston and Height above Connecticut River.

near In. 340	Flat Brook above Old mill Dam -	Canaan	162 38.61	887 82
360	Summit by Kellog's—Walnut bench -	do	163 69.04	943 25
373	S.E. side of Cross Road near Parsons' Tav	do	165 13.04	837 88
392	Floor of Piazza of Crandell's Tav. W. corner	do	167 18.74	706 38
408	Near the line between Canaan and -	Chatham	168 50.96	607 85
419	Peg near Steine Kill at Road W. of Row's H. about 3 ft. above Creek - - - -	do	169 58.99	577 29
Inst. 433	By Dorr's house (water of Pond 541. 85 ft.)	do	171 23.69	
448	Bench on White Oak opposite Bassett's Tav.	do	172 70.16	484 08
473	Peg opposite and N. of Groat's Tavern -	do	174 49.96	393 86
475	Bench on Oak right bank of Steine Kill by bridge 27.58 ft. above Creek - -	do	174 59.89	376 98
503	Bench on side hill opposite Van Vlaak's H.	do	176 60.26	294 24
518	Bench on White Oak on right bank of Kinderhook Creek 13.67 ft. above water -	do	177 76.81	241 78
534	Bench on Maple near Levi Pulver's house	do	179 45.67	294 05
543	Summitbench on stump in swamp half a mile N.W. of Tobias' - - - - -	do	180 45.80	321 10
550	Road by Luddington's H. near line between Chatham and - -	Kinderhook	181 08.38	275 90
560	Side bench on Oak 80 rods above Nivers' Mill, W. side Valitie Creek or outlet of Fish Lake which is 28.18 ft. below bench .	do	182 03.64	269 81
573	Bench on Oak S.E. side of Dickup Lake	do	183 33.82	264 85
583	Bench on Shrub Oak stump, E. side of Post road to Albany near Mr Guardinier -	Schodac	184 33.38	220 79
Inst. 596	Summit at the Road by Jack's house -	do	185 38.23	233 40
620	Bench on Walnut at Road near H. C. Guardinier's - - - - - - -	do	187 68.38	150 08
628	Bench on Pitch Pine in woods near Road	do	188 48 35	135 98
644	Bench on large White Pine on point of Ridge south of Castleton - - - - -	do	189 58.17	37 39
654	Bench on Oak west side of road northeast from Castleton - - - - - - -	do	190 66.96	25 47 below C.r
707	Top of Cap of Wharf by Ferry opposite Albany, in - - - - -	Greenbush	198 05.54	37 12 below C. r.

I have now stated the results of the various surveys, and described the courses of them; and have submitted an estimate of the cost of building a Rail Road on one route, from Boston to the state line in Canaan.

It must be understood that the Road has not been located, and therefore some variation from the line, when the work is commenced, may be expected. The cost also may be affected by changing the line.

It is impossible to select the best ground for the road on the first trial surveys; but I believe the most important objects of inquiry have been accomplished, in ascertaining that a Rail Road is practicable on the route described, and the probable cost of its construction.

Upon the profiles, in sheets, red lines are drawn, shewing the various planes of the road on all the routes, which correspond to the description of them, given in the Tables.

Plans on a reduced scale are presented, representing the principal surveys within this State, and also the line from Canaan to Albany, surveyed last year, together with a portion of the route surveyed by Mr. Young, of Albany, this season. This is represented by a dotted line, from Groat's, in Chatham, to Albany. The other portion of Mr. Young's line, was over nearly the same ground which I surveyed.

I endeavoured last year to cut off the south bend by Groat's tavern, by leaving the Steine Kill, near Row's, and taking the Northerly direction shewn on the plan; but having first to rise 180 or 190 feet above the Steine Kill, the great descent to the Kinderhook Creek, and the circuitous course I was

obliged to follow, left little hope of gaining the object on this route.

It is possible that the bend by Kellog's may be avoided, by crossing over the Dugway, by Deacon Curtis' to Parsons' Tavern. It should be further examined.

There are also presented, on a smaller scale, profiles of the main line from Boston to Canaan, by which is represented the general surface of the ground over which the survey was carried.

Hoping that the foregoing statements may prove as correct and satisfactory to you, as my endeavours have been constant to make them so,

I remain, Gentlemen, respectfully,

Your obedient servant,

JAS. F. BALDWIN, *Engineer.*

REPORT OF MR. HAYWARD

ON THE

RAIL-ROAD SURVEYS

Between Boston and Providence.

TO THE BOARD OF DIRECTORS OF INTERNAL IMPROVEMENTS,
FOR THE STATE OF MASSACHUSETTS.

Gentlemen,

Pursuant to the appointment and instructions which I received from your Honorable Board, I resumed, on the 21st of April last, the examinations of the proposed routes for a Rail Way from Boston to Providence. We commenced in the Southerly part of the City of Boston, and carried the survey near Davis' soap works, in Roxbury, crossing the lower road to Milton, near the brick-yards, and the upper road a little to the South of T. K. Jones', in Dorchester; and descending into the valley of the Neponset River, near Brush-Hill turnpike, we continued the survey on the Western side of the River, near to Sumner's paper mills. We here crossed the River, and carried the survey on the East side, uniting it with the "Eastern Route" of the former

surveys, near the house of the late John Crehore, of Milton. The whole distance from the South Boston Bridge to this point of intersection with the Old Eastern Route, is 8 miles, 52 chains. The ascent from tide water to the high ground, in Dorchester, was found to be not only less capable of a convenient distribution, but greater on the whole, than was expected. The rise from Davis' wharf to the summit, near the intersection of the line with the upper Milton Road, is 123 feet; the distance is 1 mile and 76 chains. The descent from the summit towards the South, is 80 feet, for the first 116 chains. The remainder of this branch is unexceptionable, as it respects the character and inclination of the ground; and most of it abounds with stone suitable for the foundation of the Road. We next proceeded to examine the feasibility of certain proposed improvements of the route in Canton. To avoid the bad ground on the Eastern margin of the Fowl Meadows, and the deep cutting at the place known by the name of Fountain Head, it was proposed to leave the neighborhood of the meadow, near Mr. Shawley's, and pass up a ravine nearly in the direction of the Rev. Mr. Hontoon's church, and rise gradually to the plain near the West end of the village. The Northern part of this branch is very good, much better than the corresponding part of the route near the Meadow. As we approach the village, the ground is less favorable; the rise to the plain being 100 feet in the last 50 chains. The route East of Revere's copper works, which we had proposed to examine last Autumn, was also *viewed;* but it was judged inexpedient, to examine it further.

The greatest objection to the Eastern route, being the difficulty in surmounting the acclivity from

the stone factory, in Canton, to Sharon plain, a good deal of further examination was made with reference to this point. A new route was surveyed from near Mr. Shepherd's, in Canton, passing to the West of Kingsley's Pond, crossing the Sharon road, near Capt. Hixon's, and passing up the valley to the plain, on the West side of Massapaog Lake. The distance is 3 miles and 2 chains, and the account of the level, is as follows:

Chains.	Rises Feet.	Falls Feet.	Soil.
21	18.91	..	Gravel.
8	..	9.43	..
4	(Mill Pond, 5 feet deep.)		
6	22.97	..	Sand.
8	..	21.50	..
15	30.94	..	Sand.
9	3.36	..	Sand.
7	..	15.59	..
9	20.06	..	Rocky, hard.
13	..	34.35	..
15	24.25	..	Rocky.
10	..	15.62	..
100	94.60	..	Some parts rocky.
10	..	5.39	..
7	1.93	..	..

This survey shews the line of it to be less favorable for the location of a Rail Road, than the ground previously surveyed between Kingsley's Factories and Massapaog Lake. If a survey of location is made through Sharon, I should recommend an examination a little to the East of the first survey to the Massapaog, and of the Swamp between the Lake and Thomas Clark's. It is doubtful, however, whether this part of the route can be much improved. If the Swamp can be passed, 7 or 8

feet elevation will be saved in the summit, and possibly, enough in the distance to justify the expense of excavation and embankment, which this part of the route will require.

After surveying this new route by Massapaog Lake, we returned to a point in the former survey, near the Sharon Factory, and carried the level up the valley, and on the Western (the former survey being on the Eastern) side of Johnson's Brook, ascending to the plain about 12 chains West of Mr. Reynolds' house. We crossed Sharon Plain, as had been proposed, in the general direction of Etheridge Clark's, in Foxborough; and passing to the East of Clark's house, we continued the survey, with slight variations in the line, in compliance with the irregularity of the surface, to a point in the Road, near Willard Comey's, and not far from the Baptist Church, in Foxborough. The distance from Sharon Factory to Mr. Comey's is 5 miles, 17 chains, 50 links. This line passes very near that of the former survey, where it crosses Sharon Plain; so that either part, if found better than the corresponding portion of the old line, might be conveniently substituted for it. This, however, is not the case; as we approach the plain from the North, we have an ascent of 41 feet, in 5 1-2 chains; then a fall of 36.49 feet in 10 chains; a rise of 26.52 feet in 7 chains; a descent of 39.92 feet in 2 chains; and an ascent of 60.01 feet in 17 chains; besides a precipitous side hill, for 10 chains. As we approach Etheridge Clark's, we fall gradually into a meadow; and rise again in 40 chains, 38 feet, to the summit near Mr. Clark's house. This ascent might be reduced by an embankment in the meadow, (for which there is plenty of the best gravel near by,) and an 8 or 10 feet cut at the sum-

mit. The route farther on, however, is irregular in the surface, and of such formation as to render the construction of a road very expensive; the hills being composed principally of rocks. In this vicinity there is an abundance of excellent granite. That part of the route, which lies between Mr. Reynolds', on Sharon Plain, and Mr. Clark's, may, probably with advantage, be substituted for the corresponding part of the old line, falling into it again near Stephen Boyden's. This did not occur to me, as desirable, till I had made a projection of the survey. I find by the plan, that if the line could be carried straight from Mr. Clark's to Mr. Timothy Morse's, the distance would be 5 or 6 chains less than the corresponding part of the old line. From my knowledge of the intervening ground, I have no doubt that this change is practicable.

Having proceeded in the examination of the new route by Mr. Clark's, as far as was judged expedient, we returned to a bench in our first survey, near the before mentioned Mr. Boyden's, and proceeded to examine the ground a little to the East of the former line, to ascertain whether it were possible to avoid certain rocky elevations, which appear in the profile view of the Eastern route, near the beginning of the 24th mile. In this examination, we were entirely successful. The ground, 10 chains to the East of the old survey, has no inconvenient elevations or depressions, and its geological character is favorable for such a structure as is here proposed.

We continued the survey in the general direction of Pawtucket, crossing the line of our former survey, near Mr. James Paine's, in Foxborough; a

point from which it had been proposed to survey a route to Providence, by way of Pawtucket or Central Falls. The ground had been previously explored, and in some instances stakes had been set, to indicate the most favorable ground, and the best direction for the proposed road. This line we generally followed. It crossed Wading River about 20 chains South of Williams' Factory, in Foxborough; the Worcester and Taunton road 10 chains West of Alexander Bolkcom's; and the Foxborough and Providence road, near Jesse Daggett's, in Attleborough. It passes near to Dean's Village and Attleborough City, leaving them both on the right. It crosses the Norfolk and Bristol turnpike near the toll gate, about 2 miles North of Pawtucket; and crosses Pawtucket River, just below the Island opposite Central Falls Village.

Opposite Attleborough City, this line crosses a low meadow of considerable extent, which would require very expensive embankment. In consideration of this circumstance, we went back to a bench in the survey marked 900, (which may be seen on the plan and section of this part of the route,) and carried the level in a direction bearing more to the West, passing nearer to the village, and uniting again with the survey just mentioned, near the toll gate. This line avoids most of the meadow ground, and saves much of the expense of embankment, which would be required on the line first surveyed. It is this line which is exhibited in the profile view of the route, which, together with plans and sections of the other surveys, accompanies this report.

With respect to the geological character of this route, it is proper to remark, that from Taunton

River to Wading River, the formation is hard clay and gravel. The rocks are principally sienetic granite; of this there are extensive masses in place, a little to the West of the line of the survey, with many large cobbles scattered over the surface of the ground.

From Wading River to Bungy River, the formation is loose gravel and sand. The digging in this part will be of the easiest kind. Near the line and about half way between the two rivers, is a considerable quarry of hard slate stone, suitable for the foundation of the structure.

Between Bungy River and the stream which crosses the line of the survey, near Attleborough City, the formation is a coarse gravel. There is an abundance of hard slate rock in the vicinity of the route, but little or none where excavation will be required. Between the last mentioned stream and Pawtucket River, the formation is entirely loose gravel and sand, except in one place a little North of Attleborough City, where the line just touches the point of Red Rock Hill, which projects to the East, and which consists of a coarse jasper slate. There is another quarry, or ledge of hard slate, on the bank of Pawtucket River; indeed, on both banks of the river.

Crossing the river at Central Falls, we continued the survey through the Western part of Pawtucket Village, passing a little to the West of the Episcopal Church; and keeping near the turnpike, to the town of Providence, we brought the line of our survey to the bank of the Blackstone Canal, near the 2d Lock. The subjoined section of this part of the survey, shews greater inclination in the ground than seems admissible, in such a structure. The

inclination near the summit, may be reduced by locating the line farther West; but this will increase the distance as it would be necessary to come in again near the turnpike, about 30 chains South of this summit. The descent as we approach the Canal, it will be difficult to reduce within about 40 feet in the last half mile. The location being in the suburbs of the town, there is little opportunity to choose in establishing the line, and it is inconvenient to make either extensive embankments or excavation. There will also be difficulty in continuing the Rail Way through the streets to the business part of the town, especially if the road be a double one.

Having carried the survey to Providence, we proceeded to the examination of certain routes, which had been proposed, West of the line of this survey; we first run a level along the turnpike in Attleborough, from a point a little South of the second toll gate, Northwardly to Bishop's tavern. The object of this trial level, was to ascertain the elevation of Red Rock Hill, with a view to certain improvements which had been proposed for the Western route. We run the level about 1 1-2 miles, and found an ascent of 90 feet in three quarters of a mile.

We next proceeded to survey a route from the new Eastern route, at the crossing of Wading River, through Foxborough, to the Western route in Walpole. This route is very nearly North in its general direction, and very straight. It passes near to Williams' Factory, in Mansfield; about 20 chains to the East of Gen. Leach's Iron Foundry, in Foxborough; 15 or 20 chains West of Foxborough Meeting-house; crosses the Norfolk and Bristol turnpike, a few chains North of Polley's

Tavern, and follows the valley of the Neponset, passing near the Walpole Factories, and the principal village of the town, and uniting with the old western route, at Plympton's Dam, in Walpole. From Wading River to Plympton's Dam, is 11 miles. In the first 5 miles, we have a gradual ascent of 153,12 feet; in the remaining 6 miles, there is a descent of 180 feet.

The soil through Foxborough is generally a mixture of hard clay and gravel, with an abundance of stone suitable for foundation. Within about 1 1-2 miles of this summit, is an extensive supply of excellent sienite, the best, for durability and strength of the class of rocks, commonly called granite.

As we pass into Walpole, the elevated parts of the ground are composed of a looser gravel, which in many instances is mixed with large portions of sand.

In order to distribute this descent equally through the whole distance, it will be necessary to embank considerably on the north side of the turnpike, and also in crossing the valley of the Diamond Factory, near the village in Walpole.

A route was also surveyed from Walpole through the west parish, in Dedham, falling into the Medfield road, near the Baptist Meeting-house; and leaving the road again near Samuel French's, it follows down the valley of a small brook, to the part of Dedham, called Connecticut Corner. It crosses Charles River, just above Golden's Factory, and takes the direction of the new Island Road to Spring-street, in Roxbury. It passes down a valley near Mr. Bussey's, and a little to the west of the toll gate falls into the lowland, through which it continues in a very direct course to tide water, near Wait's Mill, in Roxbury. The first

part of this route, from Stetson's Factory, in Walpole, to Samuel French's, in Dedham, (a distance of 6 miles) is very favorable. From Samuel French's to Charles River, there is a fall of 167 feet, and the distance is 2 miles, 28 chains; across the island, 98 chains, the route is level; but from the River to the summit in Spring-street, there is an ascent of 73.71 feet; and from this summit to the toll gate in Roxbury, is a fall of 128 feet, which it will be difficult so to dispose of, as to render the route practicable. From the toll gate to Wait's Mill, is a gradual descent of 19 feet, the distance is 2 1-4 miles. The whole distance from Stetson's Factory, in Walpole, to Wait's Mills, is 15 miles and 58 1-2 chains.

A route was also surveyed branching from the old western route, near Leonard Fisher's, in Dedham, and taking a direction generally less divergent from a straight line between Boston and Providence, than the corresponding portion of either of the other routes. It passes near Jabez Kingsbury's; over what is called High Plain, on the west side of Moose Hill; near Zeba Plympton's and Thomas Clap's; and unites with the Walpole and Foxborough route, near Philip Payson's, in Foxborough.

The advantages which this route seemed to offer, were, that its general course is more direct, and that it crosses Neponset River but twice, and one of these crossings is near its source, so that much expense for bridges would be saved.

The result of the survey makes this route 40 chains shorter than the route through Walpole and Foxborough.

The account of the level for the first 267 chains, is as follows:

Chains.	Rises.	Falls.
104	..	22.42
24	68.12	..
38	..	22.62
39	47.22	..
12	..	13.34
90	155.05	..
42	..	31.72
18	35.69	..

Beyond this to the south, the ground is broken and undulating, (as will be seen by the profile) with inequalities so considerable as to require several summits on the road, or a very great expense for cutting and embankment; here also the route rises to a height 19 feet greater than either of the other routes, and falling again to cross the Neponset, it unites with Walpole route, still north of the summit of that route, so that this *Moose Hill route* not only rises higher above the level of the sea than either of the other routes, but has also longer and steeper ascents to surmount, and probably a greater aggregate of rise and fall than either of the others; certainly much greater than the route through Walpole. The saving in the distance is somewhat less than was expected, and less even than might be supposed from an inspection of the plan. But the projections and irregularities in the mountain along the side of which it runs, require such short deviations from the course, as considerably increase the distance, without carrying us far from the general direction.

A survey was next made, commencing at Wait's Mill, in Roxbury, crossing the old road to Dedham, near Mr. John Lowell's; crossing the Dedham turnpike, a little to the east of the first gate, and running through a valley in a southerly direc-

tion, till it meets the Milton and Dedham road a little to the west of the junction of Mother Brook with Neponset River. From this point, a line of the survey was continued across Mother Brook and Neponset River to the eastern route, near John Crehore's; and another branch diverging to the west, crossing Mother Brook, just below the Factory, and crossing the plain to the Sprague House, where it was joined to the old western route.

From Wait's Mill to the Sprague House, is 7 1-2 miles. In the first mile there is a rise of 23 feet. For the next 3 miles, the ground is generally level, with some gentle undulations, from 20 to 30 feet above tide water. In the 5th mile there is an ascent of 7 feet; and in the 6th an ascent of 10 feet. This brings us to the summit between Wait's Mill and Neponset River, an elevation of 40 feet above the road at Wait's Mill. The descent to Mother Brook, is 17 feet—the distance 24 chains. In 11 chains after crossing the River, we rise 10 feet; and in 34 chains farther, we rise 10 feet more. This is the general level of Sprague's Plain, 55 feet above tide water. Near the Sprague House, the line crosses the valley of a small brook, 12 feet below the level of the plain, and in 3 chains rises again to the same level.

Beyond the "Sprague House," pursuing the western route to the south, the ground falls 17 feet in 29 chains; this brings the line of the survey to the western margin of the Fowl Meadows. For the next 1 1-2 miles, the ground rises 8 feet; then there is an ascent of 28 feet in half a mile; and a fall of 30 feet in the next 20 chains. This elevation is at the intersection of this route with the road leading from Canton to Dedham. It consists entirely of loose gravel.

From this place the line crosses Purgatory Swamp and Meadow; a distance of 82 chains. About the middle of this low ground, we cross a small brook, running to the east, and emptying into the Neponset. From either margin of the swamp to the brook, the ground falls 4 feet. South of Purgatory Meadow, the ground rises (near Leonard Fisher's, in Dedham) 30 feet, in 33 chains. From this summit to Neponset River, near "Morse's Plain," (a distance of 77 chains) there is a fall of 29 1-2 feet. From the River we rise 25,30 feet in 22 chains; and fall 22 feet to the River again in 14 chains. Crossing the river at this place also, we rise 47 feet in the next 21 chains. In 10 chains farther we come near to the bank of the river, opposite Morse's Mills, falling in this distance 26 1-2 feet. Thence the route continues on the northwestern bank of the Neponset, crossing the Norfolk and Bristol turnpike, near David Morse's Tavern, in Walpole, and keeping near the river to Ellis' Woollen Factory, a distance of 102 chains, and with a rise of 39 1-2 feet in the aggregate, having some small undulations, as may be seen by referring to the profile of the survey. The survey here crossed the river, and proceeded on the southern bank of the river, 12 chains to Plympton's Dam, a point before mentioned as the termination of the survey, through Foxborough and Walpole, from Wading River.

The ground from Wait's Mill, in Roxbury, to this place, is, as it respects its geological character, generally favorable for the structure proposed; from Wait's Mill to Mother Brook, the formation is hard clay and gravel, with the exception of about 8 chains of mud from 4 to 6 feet deep. From Mother Brook over Sprague's Plain, and along the western

side of the Fowl Meadows to Purgatory Swamp, the formation is gravel, and of the best kind to support a road in this climate. Across Purgatory Swamp the mud is 5 or 6 feet deep, and probably more in some parts. From Purgatory Meadow to Plympton's Dam, in Walpole, the ground is mostly gravel, with occasional intermixtures of hard clay, and in two places hard slate rock.

The ground in the other branch of the survey to the eastern route, is good gravel the most of the way, and favorable for the construction of the road.

The eastern route, from the junction of this new branch with it, extends along the south eastern side of the Fowl Meadows, with slight undulations occasioned by ravines and promontories of hard land, till it approaches the road leading from Canton to Dedham, a distance of 3 miles from the lower end of the Great Meadows. From this point onward, the character of the ground is such as to require us to leave the immediate vicinity of the Meadow, passing more to the left, and crossing a projecting portion of the high land, extending far to the west. This pass is made at a place known by the name of Fountain Head. "This is a Swamp of 10 chains in extent, lying about 20 feet below the level of the neighbouring grounds, from which it is separated on the north by a gravel ridge, 2 chains wide, and 43 feet higher than the Swamp, and on the south by a hill of sand, which rises gradually for 12 chains, then abruptly for 3 chains to the height of 67 feet above the level of the swamp, and falling off abruptly 30 feet, and then gradually to the level of the country beyond." From this point the route is very straight to the Stone Factory Dam. It here crosses the river, and continues in a direction bearing east by south, to avoid the rocky and precipit-

ous high lands, which lie between the Stone Factory and Sharon Plain. These have been particularly described, together with the lateral surveys which have been made with the hope of improving the route. From Sharon, this route may continue as before described, till it meets the Walpole and Foxborough route at the crossing of Wading River, or passing more to the east in Foxborough and Mansfield, it may cross Bungy Swamp, near Attleborough East, and cross the country in a nearly straight direction to Seekonk Cove; as described in the report of the survey of last autumn.

For the purpose of uniting the middle route with the eastern route to India Bridge by Seekonk Cove, a survey was made from the junction of the new eastern, with the Walpole and Foxborough route, near Williams' Factory, in Mansfield, in a southerly direction, till it united with the old eastern route, near the confines of Mansfield and Attleborough. The ground was found to be very good, as respects its formation, as well as the character of its surface.

A survey was also made, to ascertain the practicability of a route along the eastern bank of Pawtucket River near Pawtucket Village to Seekonk Cove. It was found, however, to be impracticable to keep near the river, on account of the irregular and broken character of the ground. But diverging from the new route near the first toll gate, north of Pawtucket, (or perhaps near Attleborough City) and passing directly to Seekonk Plain, east of Foster's Tavern, we have, thence to Seekonk Cove, ground as favorable as could be wished; from my knowledge of the ground, I feel sure that there can be no considerable obstruction between the toll gate and Foster's Tavern.

The ground was subsequently examined from

Wait's Mill to the tide water on Front-street, Boston; and also to the western extremity of Boylston-street. From Wait's Mill a Rail Way may be laid in a straight line to Ellis & Mayo's, in Washington-street, 1 mile, 57 chains; thence over the street to the water on Front-street, 8 chains. The ground is generally good; there are two or three portions of marsh, amounting in all to 29 chains.

From Wait's Mill to the western side of the Gun House, near the Hay Market, a Rail Road on the best ground would be 2 miles in length. The first mile would present no considerable obstacles to the construction of a road. The last mile would require an embankment of from 4 to 10 feet throughout its whole extent, and for half the distance the embankment would require protection from the action of the water. Several days were also spent in making examinations of the ground between the middle and western routes, in Walpole, Wrentham, and Foxborough, but not with a success which would seem to justify farther surveys.

Besides the more general examinations, the aggregate length of the several routes and branches which have been critically surveyed, the present season, is 130 miles; which, added to the 120 miles surveyed the last season, makes 250 miles of survey for the Boston and Providence Rail Way.

The surveys of the present season, it will be perceived, present two new routes from Boston to Providence, each of which may pass through Pawtucket to India Point; or by Seekonk Cove to India Bridge. The most westerly of these which may be properly called the *Middle route*, commences at Front-street, in Boston, crosses Washington-street, near Ellis & Mayo's; thence by Wait's Mill in Roxbury; and crossing the turnpike at the first

toll gate, runs through the back part of Dorchester, and the eastern part of Dedham, till it meets the Neponset River in the south part of Dedham; then passes up the valley of the Neponset, near to the centre of Foxborough; from this place it descends toward the south, and keeps near the left bank of Wading River, which it crosses on the southwest part of Mansfield.

From Wading River it passes southwesterly through Attleborough to Central Falls, crossing the turnpike at the first toll gate north of Pawtucket, crossing the River at Central Falls, it passes through Pawtucket and the east part of Providence to India Point. On keeping to the east of the Norfolk and Bristol turnpike, it may pass directly across the Plain to Seekonk Cove, and thence to India Bridge.

The *new Eastern route* branches from the middle route in the back part of Dorchester, and crossing Mother Brook and Neponset River just above their junction, it passes near the easterly margin of the Fowl Meadows, and by the Canton Factories to Sharon Plain; and then in a south southwesterly direction through Foxborough and a small part of Mansfield, to its meeting with the middle route, at the crossing of Wading River.

The most of these surveys are added to the plan of the former surveys, and sections or profiles of the ground are presented of such of them as were connected at both extremities, with the two cities or with other routes. These sections explain themselves, as the places through which they pass, are designated upon the paper above.

The routes of which estimates are presented, are the Middle, terminating at India Bridge, and the New Eastern terminating at India Point; and

also the section of the old Eastern route, from South Boston to its junction with the new Eastern in Milton, and a section from Wait's Mill, in Roxbury, to Boylston-street, in Boston.

The lengths of the several routes which these surveys present, are as follows:

	Miles.	Chains.
The most western route, from Front-street, in Boston, through Spring-street, in Roxbury, the westerly part of Dedham, Walpole, Wrentham, and Pawtucket to India Point, in Providence,	42	63
The old eastern route, from South Boston Free Bridge, through Milton, Canton, Sharon, and Attleborough East, by Seekonk Cove to India Bridge,	42	38
The new eastern route, from tide water on Front-street, by Wait's Mill, in Roxbury, through the west part of Dorchester, uniting with the old eastern route near Paul's Bridge, in Milton, and leaving it again in Foxborough, passing through Attleborough City and Pawtucket to India Point,	42	71
The middle route, from Front-street, by Wait's Mill, over Sprague's Plain, through the easterly part of Dedham, Walpole and Foxborough, uniting with the new eastern route at the crossing of Wading River, thence to India Point, as above,	42	69
Or keeping to the east of the turnpike, near the first toll gate, north of Pawtucket, and crossing at Seekonk Cove to India Bridge, the middle route will be	42	65

	Miles.	Chains.
The middle route from Front-street, to Wading River, as above—thence near Skinner's Factory, in Mansfield, to the old eastern route, to India Bridge,	42	30½
From the junction of the two eastern routes near Paul's Bridge, in Milton, to South Boston Free Bridge, through Dorchester, is	9	45
From the same point of junction, through Roxbury, to tide water, on Front-street, the distance is	9	20

From the point of divergence (in the west part of Dorchester) of the new Eastern and the Middle routes to their point of meeting at Wading River, through Walpole and Foxborough, is 2 chains shorter than that through Canton and Sharon. It will also be seen that from the toll gate north of Pawtucket, over the plain, and across the cove to India Bridge, is 4 chains shorter than the route through Pawtucket to India Point.

India Bridge, a point mentioned as one terminus of several routes, lies across the mouth of Pawtucket River. The Bridge is 600 feet in length. The water at this place is sufficiently deep for any vessels navigating Providence River. There are no houses here on the Massachusetts side; and few that are near on the Providence side.

Seekonk Cove is a small bay at the mouth of Ten Mile River; its width where we cross it is about 200 feet; its depth, at low water, is 6 feet, and at high water about 12 feet. It was formerly a place of some commerce and ship building; at present there is neither business nor houses in the place.

In estimating the expense of excavation and embankment, for the middle route, I have reduced the

inclinations so that, in no instance, does it exceed 30 feet in a mile; or that ratio for a less distance. This remark applies only to that part of the middle route which lies in Massachusetts, if we cross the Rhode Island line at Central Falls. The route from Pawtucket through the back part of Providence to India Point, has inclinations varying from 30 to 50 feet in a mile.

The estimates of excavation, &c. for the *new eastern route*, reduce the inclinations to the ratio of 30 feet per mile, excepting 4 miles, from Canton Stone Factory to Sharon Plain. The inclination in these 4 miles, varies from 30 to 80 feet per mile. It is not capable of being farther reduced, without very great expense. In the estimates for that part of the eastern route between South Boston and Paul's Bridge, I have in compliance with your instructions, admitted inclinations in the ratio of 60 feet per mile, where the natural inclinations seemed to make it convenient. About one quarter of the distance has an inclination of from 50 to 60 feet per mile. The natural inclinations on the middle route, are more gentle; and I believe (from trials which I made of several of the miles) that, admitting the same inclinations in this, the expense of excavation and embankment would be reduced to one half of that required for the scale of inclination which was adopted in the estimates; and in this case, it would not probably be requisite to exceed a 30 feet inclination for a distance of more than half a mile in any one place, and except in three or four places, they would not probably exceed an eighth of a mile in length.

The estimates here presented are for constructing a road *on the line of the survey;* but in making a survey of *location,* guided by the notes of the

former survey, and knowing more perfectly the topography of the country in the immediate vicinity of the line, and the absolute height which the ground before us, as well as that passed over will allow us to take, we should be able to save, probably, many thousand dollars of the expense required to construct the road directly upon the line of the original survey. This might in some instances affect the distance a little; and it might, in some cases, be questionable what degree of saving in the expense of excavation and embankment, would justify a given deviation from the course, or a particular increase of the distance. There is a place in the south part of Dedham, where an increase in the distance of from 20 to 30 rods, would probably save $3,000 in bridges and embankment. There will also be instances in which the distance may be shortened, as well as the route improved in other respects, by rounding the angles, and locating the line with reference to the *position* as well as *elevation*, of points through which we know that the road must necessarily pass.

The estimates for bridges and culverts, are for those of *stone*, except a few of the culverts which may be laid entirely under water, and thus all liability to decay prevented. The bridges are to consist of stone arches, laid entirely without morter of any kind, with a wall rising on each side 3 1-2 feet above the surface of the bridge, to serve the purposes of a railing, and give security to the passengers and teams. This dry masonry is preferable to that laid with any kind of cement whatever; it secures the work against a dependance upon such cement, to keep the masonry in place, which, time and the action of the weather, especially in this climate, will unavoidably destroy, and consequent-

ly produce dilapidation and ruin to the structure. It gives no opportunity for the accumulation of water, in the interior of the mason work, by the freezing of which the stones would be lifted from their place, and the safety of the bridge endangered. It also affords a drain to the road; for being covered with a kind of Mac-Adamizing or coarse gravel, the water percolates through this dressing, and the road is kept dry; a provision more important for Rail Road Bridges, which are necessarily flat, than if they admitted of a form sufficiently arching to carry off the water which accumulates upon their surface.

Besides the considerations growing out of the general character of such a work—the necessity for strength, and the advantages of durability, the very great inconveniences, and probably disastrous consequences, of failure in any part—there is one consideration which seems to me a forcible argument in favor of Stone Bridges for the Rail Way; and that is, the entire interruption to the travel and transportation upon the road, and consequently to the business which depends upon it, or a great expense for side tracks and temporary bridges, whenever the bridges of the road are to be repaired or rebuilt. And where there are 18 or 20 of these wooden bridges in 40 miles, it might be expected that besides the *repairs*, it would be necessary to rebuild, on an average, about one every year. Besides where stone may be conveniently had, the original expense of a Stone Bridge will exceed that of a wooden one only in a small ratio.

One of the routes, upon which estimates for the construction of a road are presented, crosses Pawtucket River at Central Falls, a few feet above the present bridge at that place, which is of wood, and

which cost, together with the stone work which supports it, $5,626 92. The bridges for this place contemplated in the estimates, are 200 feet in length, 22 feet in height, consisting of 4 arches of 40 feet span each; with an inclination in the walls, of 1 in 11, and side walls upon the top 3 1-2 feet high, composed of long blocks of split granite.

That for the single road is 14 feet wide at top, and will cost $4,650; that for the double road is 24 feet wide, and will cost $7,400. A bridge of the above character, and 21 feet in width, at top, will cost $6,500.

Estimates are given of the expense of construction, both of a single and double Rail Way. The *single Rail Way*, here estimated, is substantially the same as that described and recommended in the report upon the Boston and Providence routes, presented to the Executive at the last winter session of the Legislature. It consists of one pair of tracks composed of long blocks of granite, about one foot square, resting upon a foundation wall, extending to the depth of 2 1-2 feet below the surface of the ground, and two feet wide at the bottom.

The upper surface of the Rail Stone is cut smooth to receive the Iron Rail, with a straight edge a little bevelling to the depth of 1 1-2 inches, on the inside, for the flange upon the wheel. They are closely fitted at the ends, and made of the same thickness for several inches from the joint. The distance between the rails is five feet from inside to inside. The iron plate Rail is two inches wide, and 3-8 of an inch thick, with a perfectly flat surface. This is fastened upon the rail stone, by small bolts of tough iron, 3 inches long, and 3-8 of an inch in diameter. Holes of these dimensions

are drilled in the rail stone, and the corresponding holes in the plate rail, are counter sunk to enable the bolts to hold, when cut even with the surface of the rail. These fastenings are about a foot from each other along the rail. The road is gravelled between the rails, and about two feet on the outside, to the depth of six inches; which should bring the surface of the gravel to within about four inches of the top of the rail stone. And where the road is through argillaceous or vegetable earth, the trenches for the foundation wall should be lined with gravel nearly or quite to the bottom, which will prevent all action of the frost, upon the sides of the foundation. At the crossing of roads, the gravel should be brought to a level with the rails; the back part of the rail stone should rise a little above the iron rail, which is protected on the inside by a kind of edge stone, resting against the rail stone, and rising to the same height with it.

The *double Rail Way,* consists of two pairs of tracks, with four passings from one track to the other, in each mile. The distance between the two inner tracks is 5 feet; in other respects the construction is the same as that of the single Rail Way.

The number of passings for the single Way, will depend upon the frequency with which the carriages should leave the two cities at the extremities of the route. If only once in four hours, three passing places at equal distances from each other, will be sufficient. Seven passing places will allow the carriages to leave every two hours; and 15 passings will be sufficient to enable them to leave every hour of the day and night.

In estimating the expense of cutting and embanking, a width, at the surface of the road, of 12

feet for the single, and 24 feet for the double Way, with slopes at an angle of about 35 degrees with the horizon, or slopes of 3 to 2, are provided for. It is believed that banks more inclining would not afford sufficient support to the road, without a proportional increase in the width; and in deep cutting, with a greater inclination in the banks, the road would be exposed to inconvenience from the sliding down of loose gravel and sand.

In the estimates for the *middle route*, I have considered the quarries in High Rock Woods, in Foxborough, about 1 1-2 miles from the summit, as the most eligible place from which the greatest part of the supply of stone, for rail stone, can be obtained. A section of about 6 miles from Boston, will probably be most easily supplied from the Quincy quarries. The rail stone can be quarried at either place for 7 cents per foot, and by commencing the work at the summit, and working each way, and also at Boston, at the same time, such a portion of the stone might be transported on the Rail Way, as would bring the entire transportation of the rail stone, as low as 10 cents per foot on an average, without interfering at all with the progress of the work.

Upon the eastern route, though there are large quantities of sienite in the vicinity of the route, in Sharon and Foxborough, I do not know of any place in that part of the country, which affords so great facilities for obtaining the stone in large quantities, as the quarry near the summit of the middle route. Large and convenient quarries may perhaps be found near this route, as the high lands in Sharon and Foxborough abound in this kind of rocks. It is improbable, however, that the rail stones can be obtained for the eastern, as cheap as

for the middle route, and in situations which afford equal facilities for transporting them through the line of the road.

If the stone for the eastern route are obtained from High Rock quarry, they must be carried about four miles or four miles and a half, before they can be put upon the *Rail Way*, to be conveyed along the line of the road. Allowing in this case 3 cents per foot for this additional distance, the whole cost of conveying the rail stones to the spot where they are to be used, would upon the principles stated above, amount on an average to 13 cents per foot. If more convenient quarries should not be found, it may possibly be better to obtain supplies of stone for the first 15 miles of this road, from the Quincy quarries, as the route passes within about two miles of the Quincy *Rail Way*.

The iron rails, as I understand the directors have ascertained, can be had at $70 per ton, delivered along the line where they are wanted. The quantity required for one mile of single rail way, is 12 1-8 tons. The fastenings will weigh 1058 lbs. These, as they must be of the best iron, will cost 7 cents per lb. The weight of iron rails for the double way, is 26 1-12 tons, and the fastenings will weigh 2277 lbs.

In estimating the cost of the passings for the single Rail Way, I have made no additional allowance for bridges, culverts, or grubbing, as their number and location are not decided upon; for the same reason nothing is added to the estimated expense of excavation or embankment for this part of the work. The aggregate length of fifteen passings will be about a mile; the cost of which for the middle route will, as may be seen by Table No. 1, amount to $5207 60-100.

The routes which go to India Bridge, it will be perceived, all terminate on the Massachusetts side of the river. There is, however, nothing to prevent extending the road to Fox Point. The distance is 63 chains; there is no considerable difference of level, except the lateral inclination, as the road will be on the declivity of the bank, a few feet above the tide. The river at India Bridge is 600 feet wide. An open bridge suitable for the rail way can be built for about $10,000. The remaining expense of 63 chains of double rail way, will be $10,378 77. The Bridge for a single rail way will cost considerably less. The other expenses of constructing a single rail way to Fox Point, will amount to $4,573 43.

In comparing these routes with reference to facility of construction, so far as is indicated by the estimates for excavation and embankment, it is important to take into consideration the different scales of inclination, adopted in the estimates of the two routes. When I made the estimates for the middle route, I had an impression that the Directors considered it very desirable to admit no greater inclination than about the ratio of 30 feet in a mile, if it could be done at a *reasonable expense* —as a road with alternate inclinations, no greater than this, is substantially equivalent to a level way, occasioning no waste of power to the teams. I therefore adopted this scale for the middle route; but in disposing the planes for the eastern, I found it necessary to admit inclinations in the ratio of 80 feet in the mile. I have since estimated the expense of cutting and embanking, for several miles of the middle route, with inclinations varying from 30 to 50 feet per mile. The 21st mile, as it stands

in the table of estimates, has a continued inclination of 30 feet. If we surmount this 30 feet rise in 48 chains, that is, give it an inclination of 50 feet per mile, and make the remaining 32 chains, nearly level, the expense of excavating and embanking for the single way, will be reduced from $14,864 43 to $2,158 20; almost in the ratio of 7 to 1.

By an inclination of 60 feet per mile, in two places, each 12 chains long, the expense of excavation and embankment for the 24th, 25th, 26th, and 27th miles, which stand in the estimates at,

$2,867 56		$550 00	
3,000 40	will be	1,477 94	respectively.
7,945 60		2,928 64	
4,239 50		1,446 79	

And in the 28th mile by a declivity in the ratio of 40 feet per mile, for about two thirds of the way, the expense of embankment, would be reduced, for the single rail way, from $2,242 80 to $747 60. I have tried no other section of the route, but I doubt not that many of them might be reduced nearly in the above ratio.

These estimates include nothing for damage, the amount of which, I understand, that the Directors have taken measures to ascertain. One of the routes of which estimates are given, passes through the village of Pawtucket, and will require the removal of two or three buildings, but this expense, I was informed, the citizens would readily defray, to encourage the undertaking.

In the table of estimates, the cost of constructing the road, is given in sections of one mile each, numbering from Boston towards Providence. Tables No. 1 and No. 2, exhibit the cost of construction independent of the character of the ground, or any other accidental obstruction. The amount of

these items is incorporated into the other tables, in which are exhibited the expense of grubbing, piling, excavation, embankment, bridges, culverts, and crossing roads, together with the entire cost of each individual mile of road. To these are added *tables* of inclination of the two principal routes, which show also the absolute heights above Front street, near South Boston Bridge, of places on each route; as well as the entire change of level, or total ascent and descent from Boston to Providence. A summary is also added, of the most prominent facts resulting from the examinations and estimates. All which, with the plans and profiles accompanying this report, is most respectfully submitted.

JAMES HAYWARD.

No. I.

An Estimate of that part of the construction of one mile *of* single Rail Way, *which is the same for every mile.*

1. *Trenching* for the foundation, 1565 cubic yards, at 7 cents per yard, - - - - - -	$109 57
2. *Stone, and laying the foundation*, at $2 per rod of the road, - - - - - - - -	640 00
3. *Rail Stone* in blocks equivalent to a foot square, and from 6 to 12 feet long, 10,560 feet, at 17 cents per foot, delivered on the ground, - -	1,795 40
4. *Cutting the stone*, and *drilling the holes* for the fastenings, at 10 cents per foot, - - -	1,056 00
5. *Iron Rails*, prepared for nailing, 10,560 feet, equal to 12 1-8 tons, at $70 per ton, - -	848 75
6. *Fastenings*, 1,058 1-3 lbs. at 7 cents per lb. -	74 08
7. *Levelling the Rail Stone*, and securing the Iron Rail, at 5 cents per foot, - - - - -	528 00
8. *Gravelling the road*, 780 yards, at 20 cents per yard, - - - - - - - - - -	156 00
For Middle Route—Construction per mile, -	$5,207 60
Extra cost of Rail Stone for Eastern Route, -	316 80
	$5,524 40

No. II.

An Estimate of that part of the construction of one mile *of* Double Rail Way, *which is the same for every mile.*

1. *Trenching* for the foundation, 3371 cubic yards, at 7 cents per yard, - - - - - -	$236 00
2. *Stone, and laying the foundation*, 344 rods, at $4 per rod, - - - - - - - - -	1,376 00
3. *Rail Stone* in blocks equivalent to a foot square, from 6 to 12 feet long, 22,720 feet, at 17 cents per foot. delivered, - - - - - -	3,862 20
4. *Cutting the stone* and *drilling the holes*, for the fastenings, at 10 cents per foot, - - - -	2,272 00
5. *Iron Rails* prepared for nailing, 22,720 feet, 26 1-12 tons, at $70 per ton. - - - - -	1,825 00
6. *Fastenings*, 2,277 lbs. at 7 cents per lb. -	159 39
7. *Levelling the Rail Stone*, and securing the iron rail, at 5 cents per foot, - - - - -	1,136 00
8. *Gravelling the road*, 1564 cubic yards, at 20 cents per yard, - - - - - - - - -	312 80
For Middle Route—Construction for each mile -	$11,179 39
Extra cost of Rail Stone for Eastern Route, -	681 60
	$11,860 99

MIDDLE ROUTE—SINGLE RAIL-WAY.

An Estimate of the Expense of Constructing a SINGLE RAIL WAY, *from Front Street, Boston, to India Bridge; in Sections of* ONE MILE *each, except the first, which is* 65 *Chains.*

No. of Sec.	Excavation & Emb. for a 12 feet road.	Grubbing and Piling.	Bridges and Culverts.	Crossing Roads.	Expense of Construc. fr. Table No. 1.	Total expense of each mile.
	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.
1	1,745 07	00 00	50 00	62 00	4,231 17	6,088 24
2	1,329 05	680 00	1050 00	10 00	5,207 60	8,276 62
3	1,163 41	. .	820 00	45 00	5,207 60	7,236 01
4	1,155 17	. .	20 00	.	5,207 60	6,382 77
5	789 86	10 00	30 00	40 00	5,207 60	6,077 46
6	659 07	9 00	45 00	10 00	5,207 60	5,930 67
7	445 40	84 00	20 00	.	5,207 60	5,757 00
8	435 80	. .	40 00	.	5,207 60	5'683 40
9	1,585 03	. .	1265 00	34 00	5,207 60	8,091 63
10	497 50	. .	20 00	22 00	5,207 60	5,747 10
11	188 83	5 00	20 00	.	5,207 60	5,421 43
12	1,039 30	20 00	35 00	20 00	5,207 60	6,321 90
13	1,977 32	52 00	45 00	10 00	5,207 60	7,291 92
14	1,519 45	15 00	30 00	30 00	5,207 60	6,802 05
15	3,293 91	. .	2020 00	30 00	5,207 60	1,551 51
16	1,254 92	10 00	20 00	25 00	5,207 60	6,517 52
17	1,531 30	18 00	1035 00	10 00	5,207 60	7,801 90
18	2,785 13	5 00	275 00	20 00	5,207 60	8,292 73
19	4,790 82	. .	1000 00	40 00	5,207 60	11,038 42
20	1,970 58	. .	1000 00	12 00	5,207 60	8,190 19
21	14,864 43	. .	30 00	40 00	5,207 60	20,142 03
22	501 25	. .	20 00	.	5,207 60	5,728 85
23	2,242 88	. .	310 00	20 00	5,207 66	7,780 48
24	1,649 14	. .	20 00	40 00	5,207 60	6,916 74
25	1,745 93	. .	20 00	20 00	5,207 60	6,993 53
26	4,544 00	47 50	. .	.	5,207 60	9,799 10
27	2,637 59	12 00	20 00	10 00	5,207 60	7,887 19
28	2,242 80	29 00	1020 00	32 50	5,207 60	8,531 90
29	396 24	18 00	10 00	20 00	5,207 60	5,651 84
30	1,854 50	. .	75 00	10 00	5,207 60	7,147 10
31	1,618 10	. .	25 00	20 00	5,207 60	6,870 70
32	656 41	18 75	20 00	10 00	5,207 60	5,912 76
33	1,314 88	. .	285 00	10 00	5,207 60	6,817 48
34	816 96	. .	55 00	10 00	5,207 60	6,089 56
35	1,289 54	. .	270 00	15 00	5,207 60	6,782 14
36	3,173 60	. .	45 00	.	5,207 60	8,426 21

37	698 80	50 00	10 00	10 00	5,207 60	5,976 40
38	733 33	40 00	40 00	10 00	5,207 60	6,030 93
39	483 33	10 00	20 00	20 00	5,207 60	5,740 93
40	474 60	. .	20 00	20 00	5,207 60	5,722 20
41	3,725 63	20 00	30 00	30 00	5,207 60	9,013 23
42	1,428 58	. .	4665 00	.	5,207 60	11,301 18
43	1,811 45	. .	25 00	20 00	4,207 60	7,064 05
						321,826 82

MIDDLE ROUTE—Double Rail Way.

An Estimate of the expense of Constructing a Double Rail Way, *from Front Street, Boston, to India Bridge; in Sections of* one mile *each, except the first, which is* 65 *Chains.*

No. of Sec.	*Excavation & Emb. for a 12 feet road.*	*Grubbing and Piling.*	*Bridges and Culverts*	*Crossing Roads.*	*Expense of Construc. fr. Table No. 2*	*Total expense of each mile.*
	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.
1	2,490 14	. .	100 00	124 40	9,083 25	11,797 39
2	2,038 53	1360 00	1330 00	20 00	11,179 39	15,927 92
3	2,326 82	. .	1030 00	90 00	11,179 39	14,626 21
4	2,082 42	. .	30 00	.	11,179 39	13,292 81
5	789 86	20 00	50 00	80 00	11,179 39	12,119 25
6	1,167 75	18 00	70 00	20 00	11,179 39	12,455 14
7	805 60	168 00	35 00	.	11,179 39	12,187 99
8	869 60	. .	60 00	.	11,179 39	12,109 09
9	2,790 90	. .	2025 00	68 00	11,179 39	16,063 29
10	896 00	. .	30 00	44 00	11,179 39	12,149 39
11	377 67	10 00	40 00	.	11,179 39	11,607 06
12	1,417 51	40 00	20 00	40 00	11,179 39	12,696 90
13	3,469 90	104 00	70 00	20 00	11,179 39	14,843 29
14	2,337 11	25 00	50 00	60 00	11,179 39	13,651 50
15	5,028 39	. .	3035 00	40 00	11,179 39	19,287 78
16	1,543 82	20 00	30 00	70 00	11,179 39	12,843 21
17	2,892 33	25 00	1545 00	20 00	11,179 39	15,661 72
18	5,570 26	10 00	435 00	20 00	11,179 39	17,214 65
19	6,808 14	. .	1600 00	80 00	11,179 39	19,667 53
20	3,080 71	. .	1600 00	25 00	11,179 39	15,885 10
21	17,297 00	. .	45 00	80 00	11,179 39	28,601 39
22	899 06	. .	30 00	.	11,179 39	12,108 46
23	3,487 00	. .	415 00	40 00	11,179 39	15,121 39
24	2,867 56	. .	50 00	60 00	11,179 39	14,156 95
25	3,000 40	. .	35 00	40 00	11,179 39	14,254 79
26	7,145 60	95 00	. .	.	11,179 39	18,419 99

27	4,239 50	24 00	30 00	20 00	11,179 39	15,492 89
28	3,424 32	58 00	1530 00	45 00	11,179 39	16,236 71
29	769 86	36 00	15 00	40 00	11,179 39	12,040 25
30	2,804 00	.	100 00	20 00	11,179 39	14,103 39
31	2,494 43	.	35 00	60 00	11,179 39	13,768 82
32	1,235 58	27 50	40 00	20 00	11,179 39	12,502 47
33	1,947 12	.	410 00	20 00	11,179 39	13,551 51
34	1,406 60	.	90 00	20 00	11,179 39	12,695 99
35	1,872 13	.	380 00	80 00	11,179 39	13,461 52
36	4,828 60	.	60 00	.	11,179 39	16,067 99
37	1,080 00	100 00	20 00	20 00	11,179 39	12,399 39
38	1,066 66	80 00	80 00	20 00	11,179 39	12,426 05
39	816 66	20 00	40 00	40 00	11,179 39	12,096 05
40	836 41	.	30 00	40 00	11,179 39	12,125 80
41	5,249 16	40 00	50 00	60 00	11,179 39	16,578 55
42	2,229 91	.	7423 00	20 00	11,179 39	20,852 30
43	2,700 85	.	65 00	40 00	11,179 39	13,985 24
						629,134 71

NEW EASTERN ROUTE—SINGLE RAIL-WAY.

An Estimate of the Expense of Constructing a SINGLE RAIL WAY, *from Front Street, Boston, through Roxbury, Canton and Pawtucket, to India Point in Providence. In Sections of* ONE MILE *each, except the first, which is* 65 *Chains.*

No. of Section	*Excavation and Embankm't.*	*Grubbing and Piling.*	*Bridges and Culverts.*	*Crossing Roads.*	*Expense of Construc. fr. Table No. 1.*	*Total Cost of each Mile.*
	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls Cts.
1	1,745 00	. .	50 00	62 00	4,977 15	6,834 22
2	1,329 05	680 00	1050 00	10 00	5.524 40	8,593 45
3	1,163 41	. .	820 00	45 00	5,524 40	7,552 41
4	1,155 17	. .	20 00	.	5,524 40	6,699 57
5	789 86	10 00	30 00	40 00	5,524 40	6,394 86
6	659 07	9 00	45 00	10 00	5,524 40	6,247 49
7	445 40	84 00	20 00	.	5.524 40	6,073 80
8	1,025 61	. .	1020 00	10 00	5,524 40	7,580 01
9	1,386 64	16 00	1081 00	10 00	5,524 40	8,018 04
10	1,229 97	. .	65 00	10 00	5,524 40	6,829 37
11	4,724 53	. .	80 00	.	5,524 40	10,327 93
12	2,939 78	30 00	290 00	.	5,524 40	8,784 18
13	10,316 43	. .	125 00	15 00	5,524 40	15,980 83
14	4,749 12	20 00	70 00	10 00	5,524 40	10,373 52
15	5,299 67	. .	520 00	22 50	5,524 40	11,366 57
16	10,726 83	. .	60 00	37 50	5,524 40	16,348 73

17	2,445 30	. .	630 00	25 00	5,524 40	5,624 70
18	3,421 92	. .	55 00	20 00	5,524 40	9,021 32
19	13,615 13	30 00	60 00	10 00	5,524 40	19,249 53
20	496 70	. .	25 00	25 00	5,524 40	2,871 10
21	803 20	12 00	45 00	15 00	5,524 40	6,399 60
22	5,601 53	. .	235 00	10 00	5,524 40	11,370 93
23	2,592 83	10 00	65 00	10 00	5,524 40	8,202 23
24	521 02	25 00	35 00	30 00	5,524 40	6,135 42
25	534 81	. .	20 00	30 00	5,524 40	6,109 21
26	2,768 95	12 50	260 00	20 00	5,524 40	8,585 85
27	1,365 25	20 00	50 00	12 50	5,524 40	6,972 15
28	3,734 71	36 00	1000 00	25 00	5,524 40	10,320 11
29	396 24	18 00	10 00	20 00	5,524 40	5,968 64
30	1,854 50	. .	75 00	10 00	5,524 40	7,463 90
31	1,618 10	. .	25 00	20 00	5,524 40	7,187 50
32	656 41	18 75	20 00	10 00	5,524 40	6,219 56
33	1,314 88	. .	285 00	10 00	5,524 40	7,134 28
34	816 96	. .	55 00	10 00	5,524 40	6,406 36
35	1,289 54	. .	270 00	15 00	5,524 40	7,098 94
36	3,173 60	. .	45 00	.	5,524 40	8,743 00
37	698 80	50 00	10 00	10 00	5,524 40	6,293 20
38	2,992 62	. .	4710 00	45 00	5,524 40	13,272 02
39	1,543 12	. .	30 00	70 00	5,524 40	7,167 52
40	1,829 29	. .	30 00	32 50	5,524 40	7,416 19
41	1,653 77	. .	23 00	12 50	5,524 40	7,213 67
42	4,348 06	18 00	35 00	44 00	5,524 40	9,969 46
43	4,425 16	. .	30 00	24 00	5,524 40	10,003 56
						361,624 85

EASTERN ROUTE—Double Rail Way.

An Estimate of the expense of Constructing a Double Rail Way, *from South Boston Free Bridge, through Dorchester and Milton, to the point of meeting the new Eastern Route, in Sections of* one mile *each, except the first, which is* 90 *Chains.*

No. of Section	Excavation and Embankm't.	Grubbing and Piling.	Bridges and Culverts.	Crossing Roads.	Expense of Construc. fr. Table No. 1.	Total Cost of each Mile.
	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.
1	4,421 20	3400 00	1800 00	100 00	13,343 85	23,065 05
2	997 26	816 00	. .	20 00	11,860 99	13,694 25
3	3,058 40	1360 00	600 00	55 00	11,860 99	16,933 39
4	6,242 74	. .	290 00	50 00	11,860 99	18,443 73
5	4,134 66	. .	70 00	120 00	11,860 99	16,185 65
6	1,889 33	. .	5590 00	20 00	11,860 99	19,360 32
7	675 41	. .	40 00	.	11,860 99	12,576 40
8	1,094 69	. .	30 00	20 00	11,860 99	13,005 68
9	1,365 72	. .	75 00	50 00	11,860 99	13,351 71
10	4,478 64	. .	100 00	20 00	11,860 99	16,459 63
For 10 miles 10 chains of *Double Rail-Way* -						163,075 81

A Single Rail-Way *from Wait's mill in Roxbury, to the Western extremity of Boylston Street; in Sections of* one mile each.

No. of Sec.	Excavation and Embankm't.	Piling.	Bridges and Culverts	Protecting Wall, &c.	Expense of Construc. fr. Table No. 1.	Total expense of each mile.
	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.	Dolls. Cts.
1	5,182 83	680 80	75 00	1500 00	5,207 60	12,645 43
2	1,473 39	1680 00	1050 00	20 00	5,207 60	9,430 99
						22,076 42

An Estimate for a Double Rail-Way *from Wait's Mill to Boylston Street.*

1	8,375 17	1360 60	150 00	1500 00	11,179 39	22,564 56
2	2,309 00	1360 00	1330 00	30 00	11,179 39	16,208 39
						38,772 95

MIDDLE ROUTE.

A TABLE *of* INCLINATIONS *and* ELEVATIONS *in the Rail Road, from Front Street Boston, through Roxbury, Dedham, Walpole, Foxborough, Attleborough City, and across Seekonk Plain and Cove, to India Bridge.*

PLACES.	Dist. fr. Boston in Miles.	Length of Plane in miles	Ascent in Feet	Descent in Feet.	Inclin. in feet per Mile.	Height above Front Street.	Aggregate of Ascent.	Aggregate of Descent
	$\frac{1}{4}$	$\frac{1}{4}$		8	30	—8		8
Wait's Mill in Roxbury	$1\frac{3}{4}$	$1\frac{1}{2}$	12	——	7	4	12	8
	3	$1\frac{1}{4}$	23	——	20	27	35	8
Dedham Turnpike -	4	1		7	7	20	35	15
	8	4	27	——	7	47	62	15
To Mother Brook -	$8\frac{1}{3}$	$\frac{1}{3}$		9	27	38	62	24
Sprague's Plain - -	9	$\frac{2}{3}$	12	——	18	50	74	24
W. side of Fowl Meadow	10	1		15	15	35	74	39
Dedham and Canton road	12	2	13	——	7	48	87	39
Purgatory Meadow -	13	1		8	8	40	87	47
Near L. Fisher's -	$13\frac{1}{2}$	$\frac{1}{2}$	15	——	30	55	102	47
Near 1st cross. Nepon R.	14	$\frac{1}{2}$		10	20	45	102	57
At 2d cross. Neponset R.	15	1	17	——	25	62	119	57
Diamond Fac. Walpole	18	3	86	——	29	148	205	57
Turnp. near Polley's tav.	$20\frac{1}{4}$	$2\frac{1}{4}$	60	——	27	208	265	57
Summit in Foxborough	23	$2\frac{3}{4}$	72	——	27	280	337	57
Wading River - -	$27\frac{6}{10}$	$4\frac{6}{10}$	137		30	143	337	194
	$28\frac{6}{10}$	1	10	——	12	153	347	194
	$29\frac{8}{10}$	1		16	20	137	347	210
Bungy River - -	$29\frac{3}{10}$	$\frac{1}{2}$		$7\frac{1}{2}$	30	$129\frac{1}{2}$	347	$217\frac{1}{2}$
	$30\frac{3}{10}$	1	$17\frac{1}{2}$	——	20	127	$364\frac{1}{2}$	$217\frac{1}{2}$
	$32\frac{3}{10}$	2		20	15	127	$364\frac{1}{2}$	$237\frac{1}{2}$
	$35\frac{3}{10}$	3		52	20	75	$364\frac{1}{2}$	$289\frac{1}{2}$
Toll gate north of Pawtucket and Bristol Turnpike.	$36\frac{3}{10}$	1		5	10	70	$364\frac{1}{2}$	$294\frac{1}{2}$
Foster's Tavern - -	$37\frac{5}{10}$	1	$6\frac{1}{2}$	——	10	76	371	$294\frac{1}{2}$
Seekonk Plain - -	$38\frac{3}{10}$	1		$6\frac{1}{2}$	10	70	371	301
	$39\frac{3}{4}$	$1\frac{5}{10}$		12	20	58	371	313
Seekonk Cove - -	41	$1\frac{1}{4}$		35	30	23	371	348
	$41\frac{3}{4}$	$\frac{3}{4}$	$10\frac{1}{2}$	——	15	$33\frac{1}{2}$	$381\frac{1}{2}$	348
	$42\frac{5}{10}$	1		30	30	$3\frac{1}{2}$	$381\frac{1}{2}$	378

EASTERN ROUTE.

A TABLE *of* INCLINATIONS *and* ELEVATIONS *in the Rail Road from South Boston, through Dorchester, Canton, Sharon, Attleborough City, and Pawtucket, to India Point in Providence.*

PLACES.	Dist. fr. S. Boston Fr. Bridge	Length of Portion.	Ascent in Feet	Descent in Feet	Inclin. in ratio of — ft pr mile	Height above St. at Boston.	Aggregate of Ascent.	Aggregate of Descent.
Near Z. Cook's in Dorchester	2	2	16		20	16	16	
Marsh near Savin Hill	3	1		11	20	5	16	11
Summit near Bailey's	4¼	1¼	60		60	65	76	11
In Turnp. near Leed's	4 7/12	0 1/3		21	54	44	76	32
	4¾	0 1/6	6		54	50	82	32
Valley near Dr. Codman's	5¼	0½		24	53	26	82	56
	5½	0¼	8		36	34	90	56
Neponset River - -	5¾	0¼		4	20	30	90	60
	6	0¼	10		50	40	100	60
	7½	1½		6	6	34	100	66
	8½	0½	21		50	55	121	66
	8½	0½		9	20	46	121	75
Near John Crehore's	9¼	0¾	13		20	59	134	75
	9¾	0½		22	60	37	134	97
	11	1¼	34 7/12		30	71 1/12	168½	97
Punkapogue Brook -	12	1		26½	30	45	168½	123½
Fountain Head - -	13½	1½	47		32	92	215½	123½
	14	0½		18	30	74	215½	141½
	14½	0½	11		24	85	226½	141½
Canton Factory - -	15	0½		15	30	70	226½	156½
	16	1	70		80	140	296½	156½
Presbey's Factory -	16¼	0¼	6		30	146	302½	156½
Sharon Factory -	17	0¾	4		6	150	306½	156½
	17½	0½	15½		50	165½	322	156½
Johnson's Mill Sharon	17⅚	0½	39½		80	205	361½	156½
	18⅔	0⅚	49		50	254	410½	156½
	18 11/12	0¼		5	20	249	410½	161½
Summit near Reynolds' on Sharon Plain.	19⅛	0½	18		36	267	428½	161½
	21¼	1⅛		18	20	249	428½	179½
Near the crossing of	22½	1¼		36	30	213	428½	215½
Taunton River.	22 7/8	0⅜	12½		30	225½	441	215½
Near S. Boyden's in Foxborough	28¼	0⅜		7½	30	218	441	223

Brook near Mr. Robinson's Foxborough.	25½	2¼		39	30	179	441	262
	26	0½	14		30	193	455	262
Wading River - -	27⅞	1⅞		50	30	143	455	312
	28⅞	1	10		12	153	465	312
	29⅞	1		16	20	137	465	328
Bungy River -	30⅛	0¼		7½	30	129½	465	335½
	31⅛	1	17½		20	147	482½	335½
	33⅛	2		20	15	127	482½	355½
	36⅛	3		52	20	75	482½	407½
Cross. Turnp. at toll gate	37⅓	1		5	10	70	482½	412½
Central Falls -	38⅛	1		22	30	48	482½	434½
Pawtucket Street -	38⅞	0¼		19	30	29	482½	453½
	40⅛	1¼	55		50	84	537½	453½
	41⅛	1		14	40	70	537½	467½
	41¼	0½	24		48	94	561⅓	467½
	43⅛	1½		61	50	53	561½	528½
To the Head of India Wharf - -	43⅓	6Ch's		25	333	8	561½	553½

SUMMARY.

Length of the *Eastern Route* from South Boston through Canton, Attleborough City and Pawtucket to India Point, 43m. 16ch.

The whole amount of ascent, in feet -	561 1-2	
The whole amount of descent, do -	553 1-2	
Total change of Level - -	1115	
Greatest inclination in feet, per mile	80	
Cost of construction for a single road - -		$372,685 48
Average cost per mile - - - - -		8,667 10
Cost of construction for a double road - -		729,659 50
Average cost per mile - - - - -		16,968 82

NEW EASTERN ROUTE.

Length - - - - - - - -		42m. 71ch.
Whole amount of ascent in feet -	474	
" " descent " -	466	
Total change of level " -	940	
Greatest inclination in " per mile	80	
Expense of construction for a single road -		$361,624 85
Average cost per mile - - - - -		8,409 88
Expense of construction for a double road		708,439 37
Average cost per mile - - - - -		16,475 33

MIDDLE ROUTE.

Length from Front Street, to India Bridge -		42m. 65ch.
Whole amount of ascent, in feet	381 1-2	
" " descent " -	378	
Total change of level " -	759 1-2	
Greatest inclination in feet per mile	30	
Expense of construction of a single road -		$321,826 82
Average cost per mile - - - -		7,484 35
Expense of construction of a double road -		629,134 71
Average cost per mile - - - - -		14,631 04

MR. WILLARD'S REPORT

ON THE

COST OF STONE FOR THE RAIL-ROAD.

TO THE BOARD OF DIRECTORS OF INTERNAL IMPROVEMENTS, FOR THE COMMONWEALTH OF MASSACHUSETTS.

Gentlemen,

With a view of ascertaining the quantity and quality of Stone upon the line of the Western Rail-Way, denominated the southern main route, at the request of Mr. Makepeace, I accompanied him, on the line as far as Henry's Tavern in Chester. Our examinations were confined principally within short distances from the line of the road, and the result seemed to render further research unnecessary.

We however examined a number of quarries at one or two miles distance, to ascertain their qualities, and the facility with which they might be obtained, should a resort to them become necessary. In travelling westward, we found considerable quantities of granite in Needham and Natick, but none which seemed to authorize much expectation of success, until we arrived at the old Baptist Meetinghouse in Framingham, about twenty one miles from Boston.

There, we met with an extensive ledge of good granite, with-

in twenty rods of the line, well situated to work with advantage. From this place, westward, we found abundant quarries of stone, suitable for rail stone, principally granite, at distances of one to five miles upon the line, and from twenty rods, to two and a half miles from the line, until we came to the western part of Palmer, within about thirteen miles of Connecticut River at Springfield.

From this place there is not any stone suitable for rail stone, until we come to Mount Tekea, about twelve miles west of Connecticut River. Here is an abundant supply, called gneiss. They are easily quarried, lying upon the mountain, at an angle of about forty degrees, in sheets of about one foot thick, and will make as good rail stone as granite. From this place westward, similar kinds of stone, with occasional ledges of granite, are found in abundance, within a few rods of the line, and on an average within one mile of each other on the line, until we arrive at the western termination of our journey.

These ledges are all situated upon ground of greater or less elevation, above the line of the road, generally easy of access, and convenient to open; and in all cases there is a down hill course to the line of the road. Stone suitable for the trench walls are in abundance, on, and near the line, through the whole course of the route examined, except three or four miles near Boston, and five or six miles east of Connecticut River. Half a mile, on an average, would be a sufficient allowance for the transportation. In the construction of the road, the cost of transporting the stone rails, will depend in some measure upon the time allowed for executing the work. The number of hands, which can conveniently work in one place in laying down the rails, will be so limited that three miles will probably be as much as they can complete in one season. In all the sections of road which are intended to be completed in one season, separate sets of men must be placed within six miles of each other, and work towards

each other. In this case the rail stone must be supplied at those places, when they cannot conveniently be delivered along the line. The rail road cannot be used for transportation except from those places where the work is commenced. The ledges however, are so frequent on the line, that much of the stone will cost little for transportation ; as they can be moved on the rail road from these ledges, as far as one set of men are allowed to work. Should a longer time be allowed to build the road, the workmen may be placed farther apart, and more of the stone transported upon the rail road at much less expense than will otherwise be required. In estimating the cost of this work I have recurred to the cost of similar work heretofore executed. At the Bunker Hill Ledge, large quantities of granite have been split in large blocks of dimension stone, and delivered in the hammerers' shed, at three or four hundred feet distance, at 7-12 cents per cubic foot, for the last two years. The transportation of these stones was considered nearly half the labour.

It is understood that many workmen are also now employed at Quincy and Gloucester, in quarrying edge stone and cellar stone, by contract and by the day, at two and a half cents per cubic foot, they finding their own tools ; these stones are generally considered as expensive to quarry, as would be the rail stone, particularly as gouts and inequalities of one or two inches in the rail stone would do no harm, and also as the various lengths from six to ten or twelve feet would lessen the labour. From all these circumstances, I think five cents per foot, would be a very safe estimate, for all risk of the quality of the ledges, which is the only exigency to be provided for, in this item of expense.

In estimating the cost of dressing, and preparing the rail stone for the work in accordance with the sample, exhibited by Mr. Makepeace, I have compared it with the dressing of edge stone, for side walks, and other work of similar kind ; and on this com-

parison, I think forty feet would be but a reasonable day's work, and that four cents per foot in length would abundantly pay for the labour and tools. In estimating the cost of trench walls, allowing them to average two and a half feet deep, two feet wide at bottom, and eighteen inches wide at top, they would measure 10 2-3 cubic yards per rod of road. From inquiry, I found, that the price of a team of four oxen, cart, and driver, was two dollars and fifty cents per day, and that 10 1-2 cents per ton, for carting stone, would cover the day's work. I also learned, that a stone wall, three feet wide at bottom, one foot at top, and four and an half feet high, measuring five and a half cubic yards per rod. could be built for one dollar per rod—the stones dug, drawed, and laid. From these data, and considering that a similar kind of stone would be suitable for the trench walls, and that they would be as easily laid, and that the average distance to haul them would not exceed half a mile, I think double the cost of building the stone wall, which is eighteen cents per cubic yard, would cover all the difference of cost, which could probably arise. This would bring the trench wall to thirty six cents per cubic yard, or three dollars and eighty four cents per rod of road. In estimating the cost of digging the trenches, it is to be considered that the excavations are of the easiest kind, being all near the top of the ground; all fast stone to be passed over, and the earth laid directly upon the sides. The four trenches would measure a little over nine and a half cubic yards, and may be excavated for fifty cents per rod of road. The laying down the stone rail and putting on the iron rail, is a work which should be done with much care, and would require one or two men of skill and experience, whose labour would cost probably two dollars per day. The other hands, to make up the set, might be common laborers, so that the cost of the whole workmen would not exceed one dollar per day, to average them; ten men would probably be as many as could work together to advantage, and provided they all have suitable facilities for performing the work,

having all the materials at hand, they would probably be able to lay down the rail stone, drill the holes, and rivet on the iron rails of five rods of road per day. This would make this part of the work cost two dollars per rod of road. To give the greater facility to this work, it will be necessary to have a building erected and placed on rollers, on the road, and sufficiently large to board the hands and secure the tools, provided with a travelling furnace and with the addition of a piece of canvass, to spread in front of the building when it rains, that they may be enabled to work at all times. One or two long cranes should also be attached to the building, to remove the stone from the sides of the road, to the place where they are to be laid. This building, might be moved on, as the rails are finished, and always placed where required. These facilities would aid much to expedite the work, and I think could not fail to enable the men to perform the amount of work per day heretofore allotted to them.

From an estimate of the distance of one ledge from another, on the road, and the distance of side ledges, from the line, it is found that they would require an average transport of about five miles, supposing they were all taken from the line of the road, from which one mile may be fairly deducted for those immediately on the line, to be transported upon the rail road, leaving an average of four miles of transport. And supposing all this to be made on the common roads, or such other roads as may be constructed for the purpose, and this work estimated from the cost of team work in the interior, would amount to about ten and a half cents per ton, a mile; a little less than one cent per foot, per mile. At this rate the transportation of the stone rails, would cost on an average four cents per foot. Then allowing one cent per foot for opening the quarries, and constructing roads for hauling the stone, which amounts on an average, to two hundred and twenty one dollars and twenty cents per mile, of road, I think that these estimates would cover all the expense of this

part of the work. Then supposing the iron proportionally distributed at Boston, Worcester, and Springfield, and from these places distributed along the line, it would make about twenty five miles land transportation. Allowing twenty eight tons of iron per mile of road, and three dollars per ton for landing the iron at Worcester and Springfield, and the same for that retained at Boston, and ten and a half cents per ton per mile, for the land transportation, would amount to five dollars and sixty two and a half cents per ton, or one hundred and fifty seven dollars and fifty cents per mile, or within a fraction of fifty cents per rod of road. Then from these calculations the estimates would stand as follows, viz:

For quarrying the rail stone, - - -	5 cts.	per foot,
Dressing and preparing them for the work, -	4 cts.	per foot,
Hauling them to the line of road, - -	4 cts.	per foot,
For opening quarries and making roads, -	1 ct.	per foot,
Making for these items, 14 cts. per foot, or -	$9 24 cts.	per rod of road,
For digging, hauling, and laying the trench wall, - - - - - - -	3 84 cts.	per rod of road,
For excavating the four trenches, - -	50 cts.	per rod of road,
For laying down rail stone, and putting on iron rails, - - - - - -	2 00	per rod of road,
For transporting the iron rails, - -	50 cts.	per rod of road,
	$16 08 cts.	per rod of road.

Considering that in a great work of this kind, much economy may be used, in providing all necessary facilities, to expedite and lessen the amount of labour; that the whole structure is comprised of the most ordinary kind of labour; that the great amount of it will enable contractors to perform it at a much less price than small jobs of the same kind could be afforded for, and also that team work by the year can be procured at much less cost than by the day; that board also, in the interior, may be had at the cheapest rate, particularly as the number to be provided for would make it an object to accommodate them; and finally, that such competition would exist, for obtaining a

portion of the great amount of money this work would spread through the country, there can be but little doubt of obtaining the work at a fair price, and I think such price well provided for in the above statement.

All which is submitted, by your humble servant,

SOLOMON WILLARD,

Architect of the Bunker Hill Monument.

BOSTON, DECEMBER 4, 1828.